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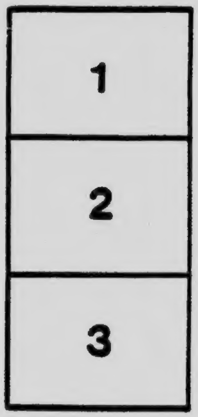

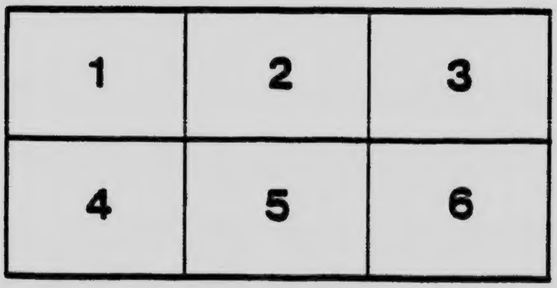

GEOLOGICAL SURVEY OF CANADA
ROBERT BELL, M.D., D.Sc. (Cantab.), LL.D., F.R.S.

REPORT

OF THE

SECTION OF CHEMISTRY AND MINERALOGY

BY

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OTTAWA
PRINTED BY S. E. DAWSON, PRINTER TO THE KING'S MOST
EXCELLENT MAJESTY
1903

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No 821

To

ROBERT BELL, M.D., D.SC. (CANTAB.), LL.D., F.R.S.
Geological Survey of Canada.

SIR,—In laying before you the accompanying report, I should mention that it does not by any means cover all the work carried out in this Laboratory during the year which it embraces—indeed scarcely more than half, a considerable number of mineral determinations, qualitative examinations, and partial quantitative analyses, the results of which have little or no interest—save to those immediately concerned, having been altogether excluded.

I have the honour to be,
Sir,
Your obedient servant,

G. CHRISTIAN HOFFMANN.

OTTAWA, 18th April, 1903.

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REPORT

OF THE

SECTION OF CHEMISTRY AND MINERALOGY

MISCELLANEOUS MINERALS.

1. Chrompicotite.

This variety of chromite—a mineral hitherto found in but one locality, namely, at Dun Mountain, in New Zealand—has been somewhat recently met with, in considerable quantity, in veins or dykes in the volcanic series of the Miocene Tertiary, on Scottie creek—a stream flowing into the Bonaparte—about nine hundred feet west of its first tributary on the south side, and some seven miles east of Mundorff, in the district of Lillooet, province of British Columbia.

The mineral, which is massive, with a fine to somewhat coarse granular structure, is associated with a pale yellow serpentine, small quantities of white to grayish-brown quartz and of white felspar, and a very small quantity of a green chromiferous silicate. It has a velvet-black colour, and is opaque; in very thin sections, however, it is translucent, and brownish-red by transmitted light. The lustre is sub-metallic. It breaks with an uneven fracture; is very brittle; and affords a grayish, inclining to blackish-brown, streak. It is non-magnetic. Its specific gravity, at 15·5 C., is 4·[illegible]39. Before the blowpipe, both in the outer and inner flame, it remains unchanged. With borax, it gives a bead which, in the oxidising flame, is yellow while hot, and pure green when cold; and in the reducing flame, is of a fine emerald-green colour, both hot and cold. With salt of phosphorus it yields a limpid glass which, in the oxidising flame, while hot, appears yellowish, and on cooling, assumes a fine green colour: whilst in the reducing flame, the bead is greenish while hot, and bright emerald-green when cold. It is not acted upon by acids.

The mean of two very closely concordant analyses, conducted by Mr R. A. A. Johnston, showed this mineral to have the following composition :—

Chromium sesquioxide	55·90
Alumina	13·83
Ferrous oxide	14·64
Magnesia	15·01
Silica	0·60
	99·98

The presence of the silica would indicate that, notwithstanding the great care exercised by Mr. Johnston in the preparation of the material employed by him for analysis—a matter attended with considerable difficulty, even with the aid of heavy solutions—the same was, nevertheless, not absolutely free from all traces of some of the associated minerals.

The above mentioned occurrence may, not improbably, mark the site of a focus of volcanic activity similar to that—some thirty miles in an east-south-east direction from it—recorded in the Annual Report of this Survey for 1894, vol. 7, p. 157 B, et *seq.*, as having been observed in connection with the large magnetite deposit at Cherry Bluff, on the south side of Kamloops lake, in the adjoining district of Yale.

2. FAUJASITE.

This species, which was alluded to in my last report— see Annual Report of this Survey for 1899, vol. 12, part R, pp. 17 and 18—as being one of the mineral associations of the datolite found at the Daisy mica mine, on the ninth lot of the first range of the township of Derry, Ottawa county, in the province of Quebec, is there met with in the form of simple octahedral crystals implanted upon the walls of small cavities in the quartz or intimately associated with the fluorite, both of which enter largely into the composition of the matrix of the datolite. The crystals vary in size from such as are of almost microscopic minuteness to others having a diameter of about two millimetres. They are mostly milk-white—with, in some instances, a faint greenish tinge—in colour, and opaque, occasionally, however, colourless and translucent, and have a vitreous lustre. Its specific gravity, at 15·5° C., determined by Mr. R. A. A. Johnston, is 2·07. In the closed tube the mineral yields much water. Before the blowpipe, it intumesces and fuses to a white blebby enamel. It is decomposed by hydrochloric acid without gelatinisation.

Its analysis afforded Mr. Johnston the following results :—

Silica	48·7
Alumina	17·0
Lime	4·6
Soda	3·2
Water (ignition)	26·0
	99·5

3. NATIVE ANTIMONY.

Some very good specimens of this mineral have been obtained by Mr. R. L. Broadbent at what is known as the Dufferin iron mine, on the eighteenth lot of the first concession of the township of Madoc, Hastings county, in the province of Ontario.

As there met with, it occurs in the form of bright tin-white lamellar masses—of which, two of the largest yet found weigh, respectively, thirty-seven and forty-nine grammes,—showing brilliant cleavage surfaces, irregularly scattered through veins of calcite traversing a body of very fine-granular, compact, massive, grayish-black magnetite, as also in the form of delicate stringers and small patches and isolated particles in the magnetite itself which is in immediate contact with the walls of the calcite veins.

Its analysis afforded Mr. R. A. A. Johnston the following results :—

Antimony	99·89
Arsenic	0·02
Iron	trace.
	99·91

4. EDENITE.

Some very fine specimens—one of which weighs close on eighteen pounds, of what on examination by Mr. R. A. A. Johnston proved to be this variety of amphibole, have been obtained, together with others illustrating its various mineral associations, by Mr. R. L. Broadbent from what is apparently a vein, on the property of Mr. Donald McPhee, on the fifteenth lot of the ninth range of the township of Grenville, Argenteuil county, in the province of Quebec.

Its associates in the veinstone—of which it is one of the most important constituents, are a grayish-white crystalline-granular pyroxene—which is the predominant mineral ; white and greenish white cleavable calcite ; yellowish-gray, smoke-gray and clove-brown sphene—both massive and in the form of distinct crystals ; white and light greenish-gray massive scapolite ; pale pink, reddish-gray and grayish-brown garnet; small crystals and small granular masses of pale green apatite, and a little graphite.

The mineral occurs in the form of somewhat finely laminated masses, having two very perfect prismatic cleavages with angular intersections of 56° and 124°, and a third moderately perfect cleavage in a direction normal to that of the principal axis; the colour is brownish-red with a hyacinthine tinge, and the pleochroism somewhat strongly marked; it is subtransparent to transparent; has a vitreous lustre, on cleavage-faces; and breaks with a subconchoidal fracture. Its hardness was found by Mr. Johnston to be a little over 6 or nearly 6·5, and its specific gravity, at 15·5°C., 3·108. Before the blowpipe, it fuses at 3. The finely pulverised fused mineral gelatinises with hydrochloric acid.

The mean of two very closely concordant analyses, conducted by Mr. Johnston, showed it to have the following composition:—

Silica	46·09
Alumina	12·93
Ferric oxide	0·79
Ferrous oxide	none.
Manganous oxide	0·36
Lime	12·91
Magnesia	20·82
Soda	2·36
Potassa	1·84
Water, at 100°C	0·18
Water, above 100°C	0·48
Fluorine	2·84
	101·60
Less oxygen, equivalent to fluorine	1·19
	100·41

This mineral would appear to be well adapted for an ornamental stone or for use in jewellery.

5. MAGNESITE.

What, on examination, proved, as here shown, to be this species' has been met with in considerable abundance, as a rock forming mineral, both in situ and in the form of drift boulders, in some parts of the township of Grenville, Argenteuil county, in the province of Quebec, where it may, not improbably, hitherto have been mistaken for dolomite, which it much resembles in appearance.

An outcropping of the mineral has been observed by Mr. R. L. Broadbent on the north-half of the eighteenth lot of the eleventh range of the township, which is about ninety feet long by some twenty feet in breadth; and some two miles and a half south-south-east of this, on the north-half of the fifteenth lot of the ninth range, Mr. W. B. McAllister has met with another outcrop which, as he informs the writer, has a width of about one hundred feet and is traceable for a distance of a quarter of a mile, more or less. The first mentioned exposure is, it may be mentioned, cut, about midway its length, by an almost vertical dyke of grayish-black diorite-porphyrite. Drift boulders of the mineral have been found on the south-halves of lots fourteen and fifteen of the ninth range of the township—where they are quite numerous, as well as on the north-half of lot ten, of the same range, whilst others have been met with on the south-half of the eleventh and north-halves of the twelfth and thirteenth lots of the eighth range. The boulders vary greatly, both in form and size. The largest yet met with, occurs on the property of Mr. H. Cooke, on the north-half of the tenth lot of the eighth range. This measures sixteen by twelve by eight feet, and is computed to weigh something in the neighbourhood of one hundred and forty tons.

On the occasion of his visit to the locality in question, Mr. Broadbent collected a great number of specimens from the exposure on the eighteenth lot of the eleventh range of the township, as likewise from the various drift boulders, which he closely followed up; and Mr. McAllister, who also spent some time in the locality, in like manner collected numerous specimens from the outcrop on the north-half of the fifteenth lot of the ninth range, and from other not far distant points. The whole of these specimens have been examined, and with the undermentioned results:—

Partial analyses, by Mr. F. G. Wait, of nine samples of the mineral taken from various parts of the outcropping, of what is most probably a bed, on the eighteenth lot of the eleventh range of the township in question, consisted, respectively, of—

1.—A fine to somewhat coarsely crystalline-granular, massive, bluish-white magnesite, containing—magnesium carbonate, 77·62; calcium carbonate, 16·07; magnesia, present in other form than that of carbonate, 3·50 per cent.

2.—A finely crystalline-granular, massive, bluish-white to white magnesite, containing—magnesium carbonate 74·68; calcium carbonate, 18·89; magnesia, present in other form than that of carbonate, 3·71 per cent.

3.—A finely crystalline-granular, massive, milk-white magnesite with a few small inclusions of yellowish-green serpentine, containing—

magnesium carbonate, 78·08; calcium carbonate, 15·57 : magnesia, present in other form than that of carbonate, 4·18 per cent.

4.—A finely crystalline-granular, massive, milk-white magnesite through which was distributed, in parts, a trifling quantity of wax-yellow serpentine, containing—magnesium carbonate, 77·16 : calcium carbonate, 10·78 ; magnesia, present in other form than that of carbonate, 6·14 per cent.

5.—A finely crystalline-granular, massive, bluish-white magnesite holding, in parts, a little yellowish-green serpentine, containing—magnesium carbonate, 76·09 ; calcium carbonate, 16·00 ; magnesia, present in other form than that of carbonate, 4·29 per cent.

6.—A finely crystalline-granular, massive, grayish-white, in parts reddish-white, magnesite, containing—magnesium carbonate, 76·97 ; calcium carbonate, 13·14 ; magnesia, present in other form than that of carbonate, 5·87 per cent.

7.—A finely crystalline-granular, massive, grayish-white dolomite with some magnesite, through which was distributed small quantities of yellow and yellowish-brown serpentine, containing—magnesium carbonate, 49·71 ; calcium carbonate, 30·14 ; magnesia, present in other form than that of carbonate, 9·17 per cent.

8.—A finely to somewhat coarsely crystalline-granular, massive, grayish-white, in parts reddish-white, magnesite with a few small inclusions of wax-yellow serpentine, containing—magnesium carbonate, 75·69 ; calcium carbonate, 19·71 ; magnesia, present in other form than that of carbonate, 3·08 per cent.

9.—A somewhat coarsely crystalline-granular, massive, grayish-white magnesite, containing—magnesium carbonate 82·72 ; calcium carbonate, 12·36 ; magnesia, present in other form than that of carbonate, 2·53 per cent.

A fair average sample prepared from equal weights of numerous fragments of the mineral taken from as many different parts of the exposure, and which, taken as a whole, were regarded by the collector as fairly representative of the mass of the material of the outcrop, was found by Mr. R. A. A. Johnston to contain—magnesium carbonate, 77·07 ; calcium carbonate, 16·28 ; magnesia, present in other form than that of carbonate, 3·22 per cent.

Picked specimens from this exposure or outcrop have, it may be mentioned, been examined by Mr. Wait, which contained a larger percentage of magnesium carbonate than either of the foregoing specimens, for instance, one, a very pretty, somewhat coarsely crystalline-granular, massive, bluish-white, translucent magnesite, was found to contain—magnesium carbonate, 85·00; and calcium carbonate, 10·80 per cent; whilst another, a rather coarsely crystalline-granular, massive, snow-white, subtranslucent to translucent magnesite, was found to contain as much as 95·50 per cent of magnesium carbonate, with but a very small proportion of calcium carbonate.

The material of the exposure on the fifteenth lot of the ninth range of the township—represented by fifty-seven specimens, taken by Mr. McAllister from various parts of the outcropping, and in such wise as to fairly represent the mineral composing it—closely resembled that of the exposure on the eighteenth lot of the eleventh range, above referred to. In other words, the specimens consisted, respectively, of a snow-white, a milk-white, a grayish-white, a reddish-white, and a greenish-white, finely to somewhat coarsely crystalline-granular, massive magnesite with, in some instances, inclusions of greenish-yellow and yellowish-green serpentine. A very carefully prepared average sample of the fifty-seven specimens—composed of equal weights of the finely ground material of each, was found by Mr. Johnston to contain—magnesium carbonate, 81·27; calcium carbonate, 13·64; magnesia, present in other form than that of carbonate, 3·66 per cent.

The drift boulders, referred to at the commencement of this article, were found to be composed of material differing but little, if indeed at all, from that of the aforementioned outcroppings. Several of these have been examined by Mr. Johnston. A fair average sample of one from the McPhee property, on the south-half of the fifteenth lot of the ninth range of the township (Grenville), consisting, for the most part, of a moderately fine crystalline-granular, bluish-white magnesite, with which was associated a small proportion of moderately fine crystalline-granular, grayish-white dolomite—the former containing a few, and the latter numerous, inclusions of yellowish-brown to brownish-yellow serpentine, afforded him—magnesium carbonate, 78·33; calcium carbonate, 15·50; magnesia, present in other form than that of carbonate, 4·13 per cent. Another, from the property of Mr. McPhee, on the south-half of the fourteenth lot of the ninth range of this township, consisting of a somewhat finely crystalline-granular, massive, milk-white magnesite, with an occasional small inclusion of wax-yellow serpentine, was found by him to contain—magnesium carbonate, 89·92; calcium carbonate, 4·39; magnesia, present in other form than that of carbonate, 4·85 per cent. Yet another, from the Campbell property, on the north-half of the twelfth lot of the eighth range of the township, consisting of a somewhat finely crystalline-granular, massive, grayish-white magnesite, with a few inclusions of wax-yellow serpentine, afforded him—magnesium carbonate, 66·28; calcium carbonate, 23·96; magnesia, present in other form than that of carbonate, 4·85 per cent. Mr. Johnston has likewise examined material from the exceptionally large boulder—previously referred to, occurring on the property of Mr. H. Cooke, on the north-half of the tenth lot of the eighth range of the township. From this, Mr. Broadbent broke off fragments from the sides and top, some five in all. They consisted, respectively, of—1) a moderately coarse crystalline-granular, milk-white dolomite; 2) a somewhat coarse cleavable bluish-white dolomite holding a few crystals of red garnet and a few minute scales of graphite; 3) a moderately coarse crystalline-granular, white to pale brownish-white dolomite; 4) a rather fine to somewhat coarsely crystalline-granular, milk-white, in parts yellowish-white, calcareous magnesite; and (5) a rather coarsely crystalline-granular, pale bluish-white calcareous magnesite. A fair average sample prepared by carefully mixing equal weights of the finely powdered material of each of these five specimens, was found by him to contain—magnesium carbonate, 71·15; calcium carbonate, 24·11; magnesia, present in other form than that of carbonate, 2·32 per cent.

The material from many other boulders, occurring in this locality, has been examined, and with the following results—that of two met with on Mr. McHardy's property, on the north-half of the thirteenth lot of the eight range, consisted, in both instances, of a moderately coarse crystalline-granular, grayish-white dolomite with, here and there, a few inclusions of wax-yellow serpentine; that of another, occurring on Mr. Campbell's property, on the south-half of the eleventh lot of the eight range, also consisted of a finely crystalline-granular, grayish-white dolomite; whilst that of two others, both on the McPhee property, on the south-half of the fourteenth lot of the ninth range, consisted—that of the one, of a moderately coarse crystalline-granular, white magnesite, with a few small inclusions of pale greenish-yellow serpentine, containing but a very small quantity of calcium carbonate; and that of the other, of a somewhat finely crystalline-granular grayish-white, in parts faint reddish and greenish-white, magnesite, containing little more than traces of calcium carbonate.

The carbonic acid was, in all instances, determined directly. The magnesia, here throughout referred to as 'present in other form than that of carbonate', manifestly indicates the presence of one or more associated magnesian minerals, such as serpentine—which was indeed observable in most of the specimens, and just possibly periclase or its alteration product brucite, or yet again, hydromagnesite, derived from the alteration of the latter.

Magnesite, it is almost unnecessary to add, is a mineral of some economic importance, it being used in the preparation of magnesium salts—such as Epsom salts, magnesia, et-cetera ; and in the manufacture of paint, paper and fire-brick. For the last named purpose it answers admirably, particularly where a highly refractive material is called for, as in the so-called basic process of iron smelting.

6. CLAY, VAR. FULLER'S EARTH.

From Rock creek, about nine miles up from its entry into the Klondike river, Yukon district, North-west Territory. Collected by Mr. R. G. McConnell.

This material—not hitherto recognised as occurring in Canada,—which constitutes the underclay of a seam of lignite at the locality mentioned, is massive ; has a light greenish-gray colour ; a dull lustre ; a greasy feel ; breaks with an earthy fracture ; scarcely adheres to the tongue ; when immersed in water falls into a pulpy impalpable powder ; is only slightly plastic, but may be formed into a soft adhesive mass with water which, however, on drying disintegrates. It is but slightly acted on by hydrochloric or sulphuric acid. When heated before the blowpipe, it swells up and fuses, with slight intumescence, at about 4, to a white glass.

Its analysis afforded Mr. R. A. A. Johnston the following results :—

Silica	60·64
Alumina	19·28
Ferric oxide	3·24
Ferrous oxide	0·51
Lime	1·64
Magnesia	2·66
Soda	1·86
Potassa	0·34
Water (ignition)	10·23
	100·40

This clay possesses all the properties of a fuller's earth. It readily decolorises mineral oils. A dark reddish-brown petroleum slowly percolated through a column of the same, ground to the requisite fineness, came out water-white.

MINERALOGICAL NOTES.

1.—**Asbestus.** Fine specimens of a faint greenish-white, silky-fine, fibrous actinolite, the fibres of which are flexible, and readily separable by the fingers, have been obtained by Mr. R. G. McConnell at a point on the Klondike river, about a mile and a half from its entry into the Yukon, Yukon district, North-West Territory.

2.—**Azurite.** Very pretty specimens of a fine berlin-blue azurite in the form of crystalline incrustations and small spherical crystal aggregates, have been obtained at the King Solomon mine, in Copper camp, at the head of Copper creek, which is a tributary of Deadwood creek—a stream flowing into Boundary creek, Yale district, in the province of British Columbia, where it occurs associated with malachite, melaconite, cuprite, lampadite, chalcocite, native copper, and hematite.

3.—**Bismuthinite.** This mineral has been met with at the Blue Bell claim, in Summit camp, near the head of Fisherman creek, a tributary of the north fork of Kettle river, Yale district, in the province of British Columbia. Specimens of the same, collected by Mr. R. W. Brock, consist of an association of a massive fibro-lamellar bismuthinite—which has been found by Mr. R. A. A. Johnston to contain traces of cadmium, with chalcopyrite, in a gangue composed of a greenish-gray andradite and a little white calcite.

4.—**Copper, Native.** Small irregular shaped particles of native copper are found more or less freely scattered through a granular massive cuprite and an accompanying ferruginous quartz occurring, with malachite, azurite, melaconite, chalcocite, hematite and lampadite, at the King Solomon mine, in Copper camp, at the head of Copper creek—a stream flowing into Deadwood creek, which is a tributary of Boundary creek, Yale district, in the province of British Columbia.

5.—**Cuprite.** This species has been found, in some abundance, associated with malachite, azurite, melaconite, chalcocite, native copper, hematite and lampadite, at the King Solomon mine, in Copper camp, at the head of Copper creek—a stream flowing into Deadwood creek, which is a tributary of Boundary creek, Yale district, in the province of British Columbia. As there met with, it occurs in the form of reddish-brown granular masses containing, as was well exemplified by specimens of the same collected by

Mr. R. W. Brock, occasional small fissures or cavities lined with minute, translucent, cubic crystals of the mineral, having a fine crimson-red colour by transmitted light, which are in some instances elongated to very slender prisms.

6.—**Lampadite**, or cupreous manganese. A variety of wad not previously recognised as occurring in Canada, has been found, in some little quantity, at the King Solomon mine, in Copper camp, at the head of Copper creek—a stream flowing into Deadwood creek which is a tributary of Boundary creek—Yale district, in the province of British Columbia, where it occurs in the form of brownish-black, compact, amorphous masses associated with melaconite, malachite, azurite, chalcocite, cuprite, native copper and hematite.

7.—**Malachite.** This species occurs, in some quantity, in the form of an earthy coating, also as a fine velvety incrustation, as likewise in small spherical crystal aggregates, and occasionally in small groups of verdigris-green and emerald-green, radiating, slender acicular prisms, associated with azurite, melaconite, cuprite, lampadite, chalcocite, native copper and hematite, at the King Solomon mine, in Copper camp, at the head of Copper creek—a stream flowing into Deadwood creek, which is a tributary of Boundary creek,—Yale district, in the province of British Columbia.

8.—**Melaconite.** The earthy, black, massive variety of cupric oxide—melaconite, has been sparingly met with, accompanying chalcocite, cuprite, malachite, azurite, native copper, lampadite and hematite, at the King Solomon mine, in Copper camp, at the head of Copper creek—a stream flowing into Deadwood creek, which is a tributary of Boundary creek,—Yale district, in the province of British Columbia.

9.—**Rutile.** Good specimens of a dark reddish-brown, subtranslucent, compact, massive rutile, have been obtained by Mr. R. G. McConnell from small quartz veins or stringers traversing igneous schists on Thistle creek, a stream entering the Yukon some eight miles above the mouth of White river, Yukon district, North-west Territory.

10.—**Tellurium, Native.** This species, not previously known, to occur in Canada, has been detected by Mr. R. A. A. Johnston in a sample of ore from a small quartz vein at the Commodore claim, situate some three miles from Van Anda, north-east side of Texada island, Strait of Georgia, province of British Columbia. The ore consisted of a white quartz carrying small quantities of galena and of copper-pyrites and, here and there, a little of the mineral in question.

11.—**Tremolite.** Very pretty specimens of a white, fine-fibrous, tremolite, in the form of plumose aggregates, embedded in a light bluish-gray calcite, have been obtained by Mr. R. W. Brock at the Morrison mine, in Deadwood camp, on the west side of Boundary creek, from three to four miles north-west of Greenwood city, Yale district, in the province of British Columbia.

12.—**Uvarovite.** This variety of garnet has been observed in a sample of material, which was sent to the Survey for examination, from near the southern end of Upper Arrow lake, on the west side, and between Despatch island and point opposite Nakusp,—on the east side of the lake, in the West Kootenay district of the province of British Columbia. The material consisted of an association of white translucent quartz with small quantities of gray, grayish-green, and grayish-brown pyroxene and white scapolite, through which was distributed aggregations of small, bright emerald-green, tranparent, imperfect crystals of chrome-garnet, together with a few scales of graphite and particles of pyrrhotite and of magnetite.

ROCKS.

1. ALTERED FELSITE.

From within half a mile of the stage stables at Hay cove, Red Islands, Richmond county, province of Nova Scotia. Geological position—Pre-Cambrian. Received from Mr. M. L. MacNeil.

A pale yellowish-greenish, light purplish-brown weathering, shale. Before the blowpipe, it fuses with difficulty, being only slightly rounded on the edges when in very fine splinters. It has a hardness of 3·5; and a specific gravity, at 15·5° C., of 2·66.

Its composition was found by Mr. F. G. Wait to be as follows :

Silica	78·06
Alumina	12·88
Ferric oxide	0·74
Ferrous oxide	0·73
Lime	0·44
Magnesia	0·86
Potassa	2·67
Soda	1·55
Water, at 100° C	0·25
Water, above 100° C	1·88
	100·06

This material, when reduced to powder and moistened with water affords a slightly plastic mass, which when burnt assumes a light reddish-brown colour. The burnt mass is difficultly fusible at a high temperature. It would make a fairly refractory fire-brick.

COALS AND LIGNITES.

[Continued from page 31R of the last Annual Report of this Survey—(vol. xii) for 1899.]

100.—LIGNITE.—From Lepine creek, a stream flowing into Rock creek which is tributary of the Klondike, Yukon district, North-west Territory.

An analysis, by fast coking, gave :

Hygroscopic water	14·38
Volatile combustible matter	34·26
Fixed carbon	42·80
Ash	8·56
	100·00
Coke, per cent	51·36
Ratio of volatile combustible matter to fixed carbon	1 : 1·25

It communicates a dark brownish-red colour to a boiling solution of caustic potash ; yields, by fast coking, a non-coherent coke ; and on incineration, leaves a reddish-brown ash.

101.—COAL.—Said to have been taken from a seam at or near White Horse, Yukon district, North-west Territory.

An analysis, by fast coking, gave:

Hygroscopic water	3·83
Volatile combustible matter	15·84
Fixed carbon	47·81
Ash	32·52
	100·00
Coke, per cent	80·33
Ratio of volatile combustible matter to fixed carbon.	1 : 3·02

It yields, by fast coking, a non-coherent coke; colour of the ash, purplish-brown.

102.—**Semi-anthracite.**—From near Blairmore, district of Alberta, North-west Territory.

An analysis, by fast coking, gave:

Hygroscopic water	1·22
Volatile combustible matter	11·70
Fixed carbon	75·67
Ash	11·41
	100·00
Coke, per cent	87·08
Ratio of volatile combustible matter to fixed carbon.	1 : 6·47

It communicates a faint brownish-yellow colour to a boiling solution of caustic potash; yields, by fast coking, a non-coherent coke; and on incineration, leaves a white ash.

103.—**Anthracite.**—Said to have been taken from a seam at White Horse, Yukon district, North-west Territory.

An analysis, by fast coking, gave:

Hygroscopic water	1·76
Volatile combustible matter	5·69
Fixed carbon	68·59
Ash	23·96
	100.00
Coke, per cent	92·55
Ratio of volatile combustible matter to fixed carbon	1 : 12·05

It communicates only a very faint brownish-yellow colour to a boiling solution of caustic potash; yields, by fast coking, a non-coherent coke; and on incineration, leaves a light reddish-white ash.

Although this fuel was said to have come from White Horse, it is not improbable that the seam from which it was taken is that occurring about ten miles west of Dugdale station, on the line of the White Pass and Yukon railway, specimens of the material of which were collected by Mr. R. G. McConnell, and by him handed to the writer for analysis, the results of which are given in the Annual Report of this Survey (vol. xii, page 30 R) for 1899.

Some partial analyses of coals from localities in the district of Alberta, North-west Territory; and from Kettle river, Yale district, province of British Columbia, are given beyond under 'Miscellaneous Examinations'.

CARBONACEOUS SHALE.

The material in question, and which has, indifferently, by some been referred to as 'bituminous shale', by others as 'coal', and yet others as 'anthracite', is found about a mile up Harris brook—a tributary of Baddeck river, or some four and a half miles west by north of the town of Baddeck, in the district known as Hunter's Mountain, Victoria county, province of Nova Scotia, where it occurs associated with the Carboniferous conglomerate.

The surface of the freshly fractured shale is dull and earthy and of a grayish-black colour, that of what would appear to be bedding planes as likewise that of jointage planes, however, is velvet-black, smooth and lustrous. It does not soil the fingers.

An analysis, by fast coking, gave as follows:

Hygroscopic water	1·18
Volatile combustible matter	14·73
Fixed carbon	28·45
Ash	55·64
	100·00

It yields, by fast coking, and that notwithstanding the large amount of ash, a coherent, but very tender, coke. Colour of the ash, very light reddish-brown.

The occurrence of a very similar material, to that above described, at Hunter's Mountain, has been referred to by Mr. Hugh Fletcher, in his report on the geology of that part of Cape Breton Island—see Report of Progress of this Survey for 1876-77, p. 454. Mr. H. S. Poole also, in his report on the inspec tion of mines in Nova Scotia for the year 1877, refers to the occurrence of a bituminous shale, by courtesy called coal, at this place, and in so doing states that material of similar character has been exposed on the flanks of several hills in the province, but nowhere has its quality improved in depth to warrant its extraction, even were it more favourably situated for working. Nor does this spot—namely, Hunter's Mountain, hold out any better inducements.

LIMESTONES AND DOLOMITES.

[Continued from page 35 R of the last Annual Report of this Survey (vol. xii), 1899.]

1.—**Limestone.** From a quarry—originally opened by Mr. C. B. Wright and now owned by Mr. E. W. Clark—on the thirty-fourth lot of concession A of Ottawa Front, township of Nepean, Carleton county, province of Ontario. Geological position—Chazy formation, Cambro-Silurian.

The material, which was examined for Mr. D. Divers, was collected by him in such wise as to represent a fair average of a vertical exposure of the upper ten feet of the working. It consisted of a bluish-gray, for the most part very fine-crystalline, limestone. Its composition was found by Mr. F. G. Wait, to be as follows:—

(After drying at 100° C.—Hygroscopic water = 0·16 per cent.)

Calcium carbonate			60·45
Magnesium carbonate			16·17
Ferrous carbonate			1·61
Manganous carbonate			trace.
Calcium sulphate		0·37	21·50
Calcium phosphate		0·41	
Alumina		0·20	
Silica, soluble		0·51	
Insoluble matter, consisting of		20·01	
Silica	14·98		
Alumina with a little ferric oxide	3·70		
Lime	trace.		
Magnesia	0·30		
Alkalies, by difference	1·03		
			99·73

2.—**Dolomite.** From Walkerton, township of Brant, Bruce county, province of Ontario.

A faintly brownish light-gray, very fine-crystalline, almost compact dolomite, intersected by numerous thin laminae of gypsum. An analysis by Mr. Wait, afforded the following results:—

Calcium carbonate		54·96
Magnesium carbonate		42·10
Ferrous carbonate, very small quantity		undet.
Calcium sulphate	1·96	2·96
Insoluble matter	1·00	
		100·02

3.—**Dolomite.** From the same locality as the preceding specimen, but taken from a different bed.

A faintly brownish light-gray, very fine-crystalline, almost compact dolomite. Its analysis afforded Mr. Wait the following results:—

Calcium carbonate	54·41
Magnesium carbonate	45·23
Ferrous carbonate, very small quantity	undet.
Insoluble matter	0·45
	100·09

4.—**Dolomite.** From the north-east side of the Narrows leading to Chief's Bay, Lake Nepigon, district of Thunder Bay, province of Ontario. This, and the following specimen were collected by Dr. A. W. G. Wilson.

A light yellowish-greenish-gray dolomite. Determinations, by Mr. Wait, of the chief constituents gave the following results:—

Calcium carbonate	27·70
Magnesium carbonate	27·90
Insoluble matter	40·00

The insoluble portion of this stone consisted of a mixture of argillaceous and siliceous matters of which the latter constituted, approximately, 6·67 per cent of the whole.

5.—**Dolomitic Limestone.** From Poshkokagan river, a stream flowing into Chief's Bay, Lake Nepigon, district of Thunder Bay, province of Ontario.

It was of a faintly yellowish-greenish-grayish colour. A partial analysis, by Mr. Wait, showed it to contain:

Calcium carbonate	47·00
Magnesium carbonate	31·70
Insoluble matter	20·00

The insoluble portion of this stone, like that of the preceding specimen, consisted of argillaceous and siliceous matters. The siliceous constituent, in this instance, amounting to, approximately, 5 per cent of the whole.

CALCAREOUS MARLS.

[Continued from page 32 R of the Annual Report of this Survey (vol. vii) for 1894.]

13.—From Marl lake, township of Flos, Simcoe county, province of Ontario. It covers the bottom of the lake, and is also said to extend over a considerable area of the immediately surrounding land. The twenty-fifth and twenty-sixth lots of the seventh and eighth concessions of the township would, it was stated, be about the centre of the deposit. Little is, as yet, known in regard to the thickness of the deposit in the lake, beyond this, that it had been probed to a considerable depth without reaching the bottom. Received from Mr. Chas. Cameron. Examined for Mr. Geo. Moberly.

The air-dried material is earthy, somewhat coherent; and has a light yellowish-gray colour. It contains a few shells, and some root-fibres.

An analysis, by Mr. F. G. Wait, showed it to have the following composition:

(After drying at 100° C.—Hygroscopic water = 0·47 per cent.)

Lime	47·92
Magnesia	0·84
Alumina	0·39
Ferric oxide	0·34
Manganous oxide	trace.
Potassa	0·04
Soda	0·10
Carbonic anhydride	38·65
Phosphoric anhydride	0·02
Silica, soluble	0·37
Insoluble mineral matter	9·81
Organic matter, viz., vegetable fibre in a state of decay, and products of its decay, such as humus, humic acid, &c.,—and, possibly, a little combined water	1·42
	99·90

Assuming the whole of the lime to be present in the form of carbonate, trifling quantities of which are, however, present in other forms of combination, the amount found would correspond to 85·57 per cent calcium carbonate.

The insoluble mineral matter, consisting of arenaceous and argillaceous matters, was found to consist of :

Silica	6·97
Alumina	1·55
Ferric oxide	0·48
Manganous oxide	traces.
Lime	0·27
Beryllia	traces.
Magnesia	0·15
Potassa	0·19
Soda	0·20
Titanium dioxide	traces.
	9·81

The arenaceous portion of the insoluble matter consisted of grains of white quartz—which constituted, approximately, eighty per cent, by weight, of the whole; grains of red and yellow garnet and of black hornblende—both abundant; some grains of black tourmaline, and a few others of magnetite.

IRON ORES.

The following partial analyses of iron ores were all—with the exception of Nos. 10, 11 and 12, which were carried out by Mr. R. A. A. Johnston—conducted by Mr. F. G. Wait.

1.—**Magnetite.** From the farm of John Hatley, Cleveland, Annapolis county, province of Nova Scotia. This, and the three following specimens were examined for Mr. Geo. E. Corbitt.

A fine-grained, massive magnetite. It was found to contain—metallic iron 44·13 per cent, insoluble siliceous matter 32·85, titanium dioxide, none.

2.—**Magnetite.** From Baker's farm, pit No. 1, Nictaux iron mines, Annapolis county, province of Nova Scotia.

A fine-grained, massive magnetite. It contained—metallic iron 53·61 per cent, insoluble siliceous matter 12·89, titanium dioxide, none.

3.—**Magnetite.** From McConnell's farm, pit No. 2, Nictaux iron mines, Annapolis county, province of Nova Scotia.

A fine-grained, massive magnetite, which was found to contain—metallic iron 55·45 per cent, insoluble siliceous matter 13·03, titanium dioxide, none.

4.—**Magnetite.** Also from McConnell's farm, but from a different opening, namely, pit No. 4.

A fine-grained, massive magnetite. Determinations gave—metallic iron 55·69 per cent, insoluble siliceous matter 15·48, titanium dioxide, none.

5.—**Magnetite** Described as coming from Chicoutimi county,—precise locality not stated, in the province of Quebec.

A somewhat coarse-crystalline, massive magnetite, with which was associated a rather small quantity of gangue composed, mainly, of quartz with some hornblende. It was found to contain—metallic iron, 39·21 per cent.

6.—**Magnetite.** From the first lot of the eight range of Wolfstown, county of Wolfe, province of Quebec.

Magnetite, with which was associated a little copper pyrites, and a small quantity of gangue composed of chloritic-schist and quartz, together with some calcite and a very little mica-schist. It contained—metallic iron 59·92 per cent, insoluble matter 7·20, titanium dioxide, none.

7.—**Magnetite.** From the fifteenth lot of the fifth concession of the township of Oso, Frontenac county, province of Ontario.

A titaniferous magnetite, with which was associated a somewhat large quantity of gangue composed, essentially, of pyroxene with a little calcite and a very little quartz. Determinations of the more important constituents gave the following results:—metallic iron 37·18 per cent, titanium dioxide 8·00, phosphorus, none; sulphur 0·18, silica 19·65. Manganese was found to be present, but only in small quantity and was, therefore, not determined.

8.—**Magnetite.** From the thirty-first lot of the twelfth concession of the township of Grattan, Renfrew county, province of Ontario.

A somewhat coarse-crystalline, massive magnetite, through which was distributed a large proportion of gangue—composed of hornblende, felspar, and quartz, together with a little iron-pyrites. It was found to contain—metallic iron 22 per cent, insoluble matter 57·23, titanium dioxide, none.

9.—**Magnetite.** From the same locality as the preceding specimen, but taken from a different part of the deposit.

The material consisted of a more or less intimate association of magnetite, hornblende, felspar and quartz, through which was scattered a few particles of iron-pyrites. Determinations gave —metallic iron 19·25 per cent, insoluble matter 61·52, titanium dioxide, none.

10.—MAGNETITE. From near the west end of Turtle lake, north of the north-eastern extremity of the north-east arm of Lake Temagami, district of Nipissing, province of Ontario. Collected by Dr. A. E. Barlow.

An intimate association of a fine-granular magnetite and white quartz, traversed by layers of red jasper. It contained—metallic iron 36·56 per cent, insoluble siliceous matter 46·69, titanium dioxide, none.

11.—MAGNETITE. From an extensive exposure on Iron lake, north of the north-east arm of lake Temagami, district of Nipissing, province of Ontario. This, and the following specimen were collected by Dr. A. E. Barlow.

The description given of the preceding specimen applies also to this one. It was found to contain—metallic iron 51.40 per cent, insoluble siliceous matter 27·83, titanium dioxide, none.

12.—MAGNETITE. From a short distance north of the north-east arm of lake Temagami, district of Nipissing, province of Ontario.

The material of this specimen was of very much the same character as that of the two preceding ones. Determinations gave—metallic iron 46·56 per cent, insoluble siliceous matter 30·47, titanium dioxide, none.

13.—MAGNETITE. From a deposit of considerable extent near Flying Post, Mattagami river, district of Algoma, province of Ontario.

It consisted of a more or less intimate association of magnetite with a somewhat large proportion of gangue composed, mainly, of quartz with some hornblende. A carefully prepared average sample of three large fragments of the ore was found to contain —metallic iron 43·93 per cent, insoluble siliceous matter 33·82, titanium dioxide, none.

14.—MAGNETITE. From mountain north of Whitefish lake, three miles north of the west line of the township of Strange, district of Thunder Bay, province of Ontario. This, and the following specimen were collected by Mr. W. McInnes.

A very fine-grained, compact, massive magnetite, through which was distributed a somewhat large proportion of gangue composed, essentially, of hornblende with some quartz. It contained—metallic iron 46·54 per cent, insoluble matter 27·71, titanium dioxide, none.

15.—MAGNETITE. From about half a mile west of Whitefish station, on the Port Arthur, Duluth and Western Railway, township of Strange, district of Thunder Bay, province of Ontario.

An exceedingly fine-grained, compact, massive magnetite, through which was distributed a somewhat large proportion of gangue composed, mainly, of hornblende with some quartz. Determinations gave—metallic iron 45·75 per cent, insoluble matter 27·24, titanium dioxide, none.

16.—MAGNETITE. From the outcrop of a deposit on Sutton lake, west side of James Bay, district of Keewatin. This, and the following two specimens were collected by Mr. D. B. Dowling.

The material, which was taken from the uppermost bed, consisted of a very fine-granular, massive, dark-gray, laminated magnetite. It was found to contain—metallic iron 33·40 per cent, insoluble siliceous matter 48·49, titanium dioxide, none.

17.—MAGNETITE. From the same deposit as the preceding specimen, but from a depth of thirty-five feet below where that was taken.

A massive, very fine-granular to almost compact, dark-grayish, laminated magnetite. It contained—metallic iron 68·62 per cent, insoluble siliceous matter 4·21, titanium dioxide, none.

18.—MAGNETITE. From the same deposit as the two preceding specimens, but taken from a depth of ninety feet from the surface.

An association of a very fine-granular, grayish-black magnetite with a chestnut-brown coloured jasper. Determinations gave—metallic iron 27·72 per cent, insoluble siliceous matter 61·12, titanium dioxide, none.

19.—HEMATITE. From the farm of Lachlan McQuarrie, on the west side of Middle river, Victoria county, province of Nova Scotia. Examined for Mr. John McLeod.

An association of micaceous iron ore with a little earthy hematite. It was found to contain—metallic iron 67·88 per cent, insoluble siliceous matter 1·30.

20.—**Hematite.** From the township of Sarawak, Grey county, province of Ontario. Examined for Mr. John Mackenzie.

The material, which was in the form of irregular shaped nodules, was found to contain—metallic iron 37·57 per cent, insoluble siliceous matter 41·34, titanium dioxide, none.

21.—**Hematite.** From a deposit south of Waboose lake, district of Thunder Bay, province of Ontario. Collected by Dr. A. W. G. Wilson.

An earthy, purplish-red hematite through which was disseminated a few scales of specular iron. Determinations gave—metallic iron 57·11 per cent, insoluble siliceous matter 11·96.

22.—**Limonite.** From the Lower Mattagami river,—where it is said to occur in considerable quantity, district of Algoma, province of Ontario. Collected by Mr. J. M. Bell.

A compact, massive limonite, which, on examination was found to contain—metallic iron 50·99 per cent, insoluble siliceous matter 9·70.

23.—**Limonite,** var. bog ore, from a deposit at Port Kells, south side of the Fraser, district of New Westminster, province of British Columbia. The material which was received from, and examined for, Mr. Geo. de Wolf, was found to contain—metallic iron 44·04 per cent, insoluble siliceous matter 15·89.

NICKEL AND COBALT.

Estimation of, in certain ores from the undermentioned localities in the provinces of Nova Scotia, Quebec, Ontario, and British Columbia. Continued from page 38 R. of the Annual Report of this Survey (vol. xii) for 1899.

1.—**Pyrrhotite.** From a point described by the sender as near Boularderie Centre, Victoria county, province of Nova Scotia. Examined for Mr. William Haggerty.

A massive pyrrhotite, through which was distributed a few particles of copper-pyrites and a small quantity of gangue composed, mainly of hornblende with a little quartz. An analysis by Mr. F. G. Wait showed it to contain:

Nickel	0·07 per cent.
Cobalt	trace.

The gangue constituted 12·41 per cent, by weight, of the whole. The metalliferous portion of the ore contained, therefore, 0·08 per cent of nickel.

2.—**Pyrrhotite.** From the fourteenth lot of the fifth range of the township of Masham, Ottawa county, province of Quebec. Examined for Mr. W. L. Marler.

A massive pyrrhotite, through which was disseminated a very small quantity of quartz. Mr. Wait found it to contain:

Nickel	0·11 per cent.
Cobalt	none.

3.—**Pyrrhotite.** From the same locality as the preceding specimen, but taken from a different part of the deposit.

It consisted of pyrrhotite, with which was associated a little iron-pyrites and a very small quantity of gangue composed, essentially, of black garnet and pyroxene with a very little quartz. Determinations by Mr. Wait gave:

Nickel	0·10 per cent.
Cobalt	none.

4.—**Pyrrhotite.** From a cutting on the Whitney and Opeongo Railway, about seven and a quarter miles from its junction with the Canada Atlantic Railway, township of Sproule, district of Nipissing, province of Ontario. Examined for Mr. A. H. N. Bruce.

A compact, massive pyrrhotite, through which was distributed a few particles of copper-pyrites and a small quantity of gangue composed, mainly, of quartz and felspar with a very little garnet. It was found by Mr. Wait to contain:

Nickel	0·19 per cent.
Cobalt	traces.

5.—**Pyrrhotite.** From the seventeenth lot of the second concession of the township of Westmeath, Renfrew county, province of Ontario.

An association of pyrrhotite with very small quantities of copper-pyrites, apatite, and black hornblende. It was found by Mr. R. A. A. Johnston to contain:

Nickel	faint traces.
Cobalt	none.

6.—**Pyrite.** From the north-half of the fourth lot of the fourth concession of the township of Graham, district of Algoma, province of Ontario, where it occurs associated with pyrrhotite, copper-pyrites, and some danaite.

A massive iron-pyrites, through which was distributed a very small quantity of rock matter—not more than 1·04 per cent. Determinations by Mr. Wait gave :

Nickel	0·40 per cent.
Cobalt	trace.

7.—**Pyrrhotite.** From the south-half of the eighth lot of the fourth concession of the township of Dowling, district of Algoma, province of Ontario.

A massive pyrrhotite with which was associated a little copper pyrites, and a somewhat large proportion of gangue. The pyrrhotite freed from the copper pyrites and all gangue was found by Mr. Wait to contain :

Nickel	0·26 per cent.
Cobalt	trace.

8.—**Pyrrhotite.** From the west-half of the tenth lot of the fourth concession of the township of Olden, Frontenac county, province of Ontario. Examined for Mr. J. Bawden.

A granular, massive pyrrhotite, with which was associated a very little copper-pyrites, and a small quantity of gangue composed, essentially, of felspar with a little quartz and hornblende. An analysis by Mr. Wait showed it to contain :

Nickel	0.98 per cent.
Cobalt	trace.

The gangue constituted 3·32 per cent, by weight, of the whole. The metalliferous portion of the ore contained, therefore, 1·02 per cent of nickel.

9.—**Pyrrhotite.** From the mountain west of Ice river, about six miles from the forks of Ice and Beaverfoot rivers, East Kootenay district, province of British Columbia. Examined for Mr. James Walker.

A compact, massive pyrrhotite, through which was distributed a trifling quantity of siliceous gangue—not more than 0·20 per cent. Determinations by Mr. Wait gave :

Nickel	0·12 per cent.
Cobalt	none.

10.—**Pyrrhotite.** From the north bank of the Thompson, about five miles above Lytton, Yale district, province of British Columbia. Examined for Mr. Geo. de Wolf.

An association of a fine-granular, massive pyrrhotite with some iron-pyrites and very little copper-pyrites, through which was distributed a somewhat large quantity of gangue composed, mainly, of hornblende and quartz. It was found by Mr. Wait to contain:

Nickel	0·08 per cent.
Cobalt	trace.

The gangue constituted 17·72 per cent, by weight, of the whole. The metalliferous portion of the ore contained, therefore, 0·097 per cent of nickel.

11.—**Pyrrhotite.** From Shuswap lake, Yale district, province of British Columbia. Examined for Mr. J. T. Edwards.

An association of a compact, massive pyrrhotite with a little copper-pyrites, through which was scattered a somewhat large quantity of quartzose gangue. Determinations by Mr. Wait gave:

Nickel	trace.
Cobalt	none.

The gangue constituted 15·75 per cent, by weight of the whole.

GOLD AND SILVER ASSAYS.

These were all conducted by Mr. R. A. A. Johnston.

As explanatory of the many instances in which no trace of either gold and silver was found, it may be mentioned that in nearly all these cases the assay was carried out by special request.

Province of New Brunswick.

1.—From what was described, in a general way, as the Tobique waters. Examined for Mr. F. H. Hale.

An association of white sub-translucent quartz, more or less stained with hydrated peroxide of iron, with small quantities of greenish-gray chloritic schist.

It contained neither gold nor silver.

2.—From the same locality as the preceding specimen.

A white sub-translucent quartz, more or less stained with hydrated peroxide of iron, with which was associated small quantities of a greenish-gray chloritic schist.

It contained neither gold nor silver.

3.—From the same locality as the two preceding specimens.

A more or less rust-stained, white sub-translucent quartz with which was associated small quantities of a greenish-gray chloritic schist.

It contained neither gold nor silver.

PROVINCE OF QUEBEC.

4.—From the land of Mr. Landreville, in the third range of the township of Acton, near the village of Actonvale, county of Bagot.

A light gray to grayish-white crystalline limestone with which was intimately associated some grayish-white quartz carrying very small quantities of copper-pyrites and pyrrhotite. The sample, consisting of two fragments, weighed two ounces and a half. It was found to contain :

Gold.................. none.
Silver, at the rate of... 0·466 of an ounce to the ton of 2,000 lbs.

5.—From a small island in Upper Abitibi lake, about fourteen miles west of the Hudson Bay Company's Post. Collected by Mr. W. J. Wilson.

A white translucent quartz, more or less coated with hydrated peroxide of iron, carrying small quantities of iron-pyrites. The sample, consisting of nine fragments, weighed three pounds eleven ounces.

It contained neither gold nor silver.

6.—From a quartz vein at Kewagama lake, some seventy-five miles south-east of Abitibi Post, Lake Abitibi. Collected by Mr. J. F. E. Johnston.

A white translucent quartz carrying somewhat large quantities of iron-pyrites. The sample, a single fragment, weighed twelve ounces. Assays gave :

Gold, at the rate of....0·117 of an ounce to the ton of 2,000 lbs.
Silver.................none.

PROVINCE OF ONTARIO.

7.—From Lake Temiscamingue, district of Nipissing. Examined for Mr. Joseph Beaubien.

An association of quartz, felspar and a little mica, in parts stained with hydrated peroxide of iron and green carbonate of copper, through which was distributed very small quantities of copper-pyrites.

It contained neither gold nor silver.

8.—From the second lot of the first concession of the township of Rayside, district of Algoma. Examined for Mr. A. J. Fraser.

A white translucent quartz, stained and coated with hydrated peroxide of iron and a little green carbonate of copper, carrying small quantities of iron-pyrites and copper-pyrites. The sample, consisting of two-fragments, weighed ten ounces. Assays showed it to contain:

Gold...................none.
Silver, at the rate of....0·058 of an ounce to the ton of 2,000 lbs.

9.—From the thirtieth lot of the first concession of the township of Miller, Frontenac county. Examined for Mr. L. B. Simons.

A white translucent quartz, in parts coated with hydrated peroxide of iron, carrying somewhat large quantities of iron-pyrites. The sample, consisting of numerous small fragments, weighed ten pounds.

It contained neither gold nor silver.

10.—From the west-half of the seventeenth lot of the third concession of the township of Galway, Peterborough county. Examined for Mr. R. Elliott.

A massive iron-pyrites with which was associated a small quantity of a quartzose gangue.

It contained neither gold nor silver.

DISTRICT OF KEEWATIN.

11.—From a gold-prospect on Lake Jasper. Collected by Prof. A. W. G. Wilson.

An association of greenish-gray mica-schist with a little white translucent quartz, carrying small quantities of iron-pyrites. The sample, consisting of several fragments, weighed fourteen ounces.

It contained neither gold nor silver.

NORTH-WEST TERRITORY.

12.—From Great Slave lake, district of Mackenzie. Examined for Mr. R. H. Harding.

A coarse-crystalline galena, with which was associated a small quantity of calcareous gangue. The sample, a single fragment weighed an ounce and a half. It was found to contain:

Gold.................................... none.
Silver...................................distinct trace.

13.—From Lepine creek, which flows into Rock creek a tributary of the Klondike, Yukon district. This, and the four following specimens were collected by Mr. R. G. McConnell.

A light gray, slightly calcareous, quartzo-felspathic schist, through which was disseminated fine particles of iron-pyrites. The sample, a single fragment, weighed fifteen ounces.

It contained neither gold nor silver.

14.—From Lone Mountain, Macmillan river, Yukon district.

A dark-gray, contorted schist, holding small quantities of iron-pyrites. The sample, a single fragment, weighed one pound two ounces.

It contained neither gold nor silver.

15.—From mountain opposite Cache creek, Macmillan river, Yukon district.

A grayish-white quartz, in parts coated with hydrated peroxide of iron. The sample, a single fragment, weighed fourteen ounces.

It contained neither gold nor silver.

16.—From Macmillan Mountain, Macmillan river, Yukon district.

A milk-white quartz, slightly coated with hydrated peroxide of iron. The sample, a single fragment, weighed fifteen ounces.

It contained neither gold nor silver.

17.—From Dromedary Mountain, Macmillan river, Yukon district.

A gray, laminated quartz, through which was distributed numerous fine particles of iron-pyrites. The sample, a single fragment, weighed eight ounces.

It contained neither gold nor silver.

18.—From about forty miles north-east of Dawson, in the Ogilvie Range, Yukon district. Examined for C. A. Celene.

The material was made up of three distinct samples consisting, respectively, of—(*a*) galena, iron-pyrites, and brown zinc-blende in a gangue of weathered rock matter; (*b*) a white subtranslucent quartz, more or less coated with hydrated peroxide of iron, carrying a somewhat large quantity of iron-pyrites; and (*c*) of an association of a fine grained granite with some white quartz and a little calcite, in parts coated with hydrated peroxide of iron, carrying small quantities of coarsely crystalline galena and of iron-pyrites. A fair average of the three foregoing samples was found, on assay, to contain :

Gold, at the rate of.... 0·117 of an ounce to the ton of 2,000 lbs.
Silver, at the rate of....18·725 ounces „ „

19.—Also from a point some forty miles north-east of Dawson, in the Ogilvie Range, Yukon district. Received from Mr. C. A. Celene.

The material consisted of nineteen small samples of finely crushed rock matter in which, in some instances, galena and iron-pyrites were distinctly visible. Weight of the whole, two pounds fourteen ounces. A fair average of the same was found to contain.

Gold, at the rate of.... 0·175 of an ounce to the ton of 2,000 lbs.
Silver, at the rate of.... 7·700 ounces „ „

20.—From Miller creek, a tributary of Sixty-mile river, Yukon district.

A small nugget of native gold from this stream, collected by Mr. R. G. McConnell, was found to have the following composition—Gold 79·564, silver 12·221, quartz 8·215 = 100·00 ; or, excluding the associated quartz, gold 86·685, silver 13·315 = 100·00.

21.—This, and the two following specimens are from a point on the McQuestan, about one hundred and twenty miles above its entry into the Stewart, Yukon district. Examined for W. E. Brown.

It consisted of an association of white quartz with a very little greenish-white ferriferous serpentine, holding a few particles of iron-pyrites. The sample, a single fragment, weighed two pounds nine ounces. Assays showed it to contain :

Gold, at the rate of ... 2·100 ounces to the ton of 2,000 lbs.
Silver... .... none.

22.—A weathered siliceous rock, carrying small quantities of iron-pyrites. The sample, a single fragment, weighed one pound five ounces. It contained :

Gold .... trace.
Silver....... .. .. none.

23.—A gray quartz carrying small quantities of iron-pyrites. The sample, a single fragment, weighed fifteen ounces. Submitted to assay, it was found to contain :

Gold, at the rate of .. 0·117 of an ounce to the ton of 2,000 lbs.
Silver... .... none.

24.—From the head of Gold Bottom creek, a tributary of Hunker creek, Yukon district. This, and the five following specimens were collected by Mr. R. G. McConnell.

An association of greenish-gray chloritic schist and white subtranslucent quartz, incrusted with a little blue carbonate of copper, and pitted with a brownish-black earthy substance resulting from the weathering of copper-pyrites. The sample, a single fragment, weighed ten ounces. Assays gave:

Gold..................	none.
Silver, at the rate of....	0·292 of an ounce to the ton of 2,000 lbs.

25.—From Sixty-mile river, a tributary of the Yukon, one mile below Twelve-mile creek, Yukon district.

A white quartz, in parts stained with hydrated peroxide of iron, holding a few scales of yellowish white mica. The sample, a single fragment, weighed one pound one ounce. Assays showed it to contain:

Gold, at the rate of....	0·058 of an ounce to the ton of 2,000 lbs.
Silver................	none.

26.—From Sixty-mile river, six miles above its entry into the Yukon, Yukon district.

A light brownish-gray drusy quartz. The sample consisting of two fragments, weighed one pound eleven ounces. It contained:

Gold, at the rate of 0·117 of an ounce to the ton of 2,000 lbs.

27.—From German creek, a tributary of the South Fork of the Salmon, Yukon district.

A white subtranslucent quartz. The sample, a single fragment, weighed fifteen ounces.

It contained neither gold nor silver.

28.—From Gold Run creek, opposite claim thirty-three, Yukon district.

A white subtranslucent quartz stained with hydrated peroxide of iron. The sample, a single fragment, weighed eight ounces. It was found to contain:

Gold, at the rate of....	0·350 of an ounce to the ton of 2,000 lbs.
Silver................	none.

29.—From the Lone Star claim, at the head of Victoria gulch, Bonanza creek, Yukon district.

An association of white subtranslucent quartz with a little yellowish-white mica, carrying small quantities of iron-pyrites, copper-pyrites, and galena. The sample, a single fragment, weighed one pound one ounce. Assays gave :

Gold, at the rate of	2·625 ounces to the ton of 2,000 lbs.
Silver at the rate of....	3·267 ounces 〃 〃

PROVINCE OF BRITISH COLUMBIA.

30.—From a claim on Ice river, a tributary of the Beaverfoot, East Kootenay district. This, and the two following specimens were examined for Mr. James Walker.

A white translucent quartz, in parts coated with blue and green carbonates of copper, carrying small quantities of copper-glance. The sample, consisting of three fragments, weighed eight ounces. Assays showed it to contain :

Gold..................	distinct trace.
Silver, at the rate of...	4·200 ounces to the ton of 2,000 lbs.

31.—Also from a claim on Ice river—the locality referred to in connection with the preceding specimen.

A white translucent quartz, here and there coated with blue and green carbonates of copper, holding small quantities of galena and copper-glance and a few small crystals of iron-pyrites. Submitted to assay, it was found to contain :

Gold..................	distinct trace.
Silver, at the rate of...	2·158 ounces to the ton of 2,000 lbs.

32.—From a claim on the North Fork of the Beaverfoot, East Kootenay district.

An association of a white quartz with a white dolomite, through which was distributed a few particles of copper-pyrites. The sample, a single fragment, weighed fifteen ounces. Assays gave :

Gold...	none.
Silver, at the rate of...	0·117 of an ounce to the ton of 2,000 lbs.

33.—From the Eureka claim, one of the Adair group, on Laforme creek, Columbia river, about twenty miles north of Revelstoke, West Kootenay district. Examined for Mr. J. F. Hutchison.

An association of a white subtranslucent quartz with a little black graphitic schist, carrying small quantities of copper-pyrites, and trifling quantities of zinc-blende and galena. The sample, consisting of several fragments, weighed one pound three ounces. It contained :

Gold.................. trace.
Silver, at the rate of... 2·683 ounces to the ton of 2,000 lbs.

34.—From Midge creek, a stream flowing into the lower end of Kootenay lake from the west, West Kootenay district.

A granular-massive association of iron-pyrites and white quartz. The sample, consisting of several fragments, weighed five ounces.

It contained neither gold nor silver.

35.—From the same locality as the preceding specimen.

An intimate association of a slightly weathered iron-pyrites and white quartz. The sample, a single fragment, weighed three ounces. It was found to contain :

Gold.................. none.
Silver, at the rate of... 0·058 of an ounce to the ton of 2,000 lbs.

36.—Also from Midge creek—above referred to.

A gray quartz, more or less coated with hydrated peroxide of iron, carrying very small quantities of iron-pyrites. The sample, a single fragment, weighed two ounces. Assays gave :

Gold.................. none.
Silver, at the rate of... 0·058 of an ounce to the ton of 2,000 lbs.

37.—From the Jacobs Ladder claim, West Kootenay district. Examined for Dr. G. W. Thomas.

An association of white quartz and gray chloritic schist, in parts coated with hydrated peroxide of iron. The sample, consisting of six fragments, weighed one pound fourteen ounces. It contained :

Gold.................. none.
Silver, at the rate of... 0·233 of an ounce to the ton of 2,000 lbs.

38.—From a shaft, of some ten feet in depth, sunk on a vein situate between the Forks of Five-mile creek, a stream flowing into the West Arm of Kootenay lake, West Kootenay district. This, and the following specimen were examined for Mr. C. J. Robertson.

An association of pyrrhotite, brown zinc-blende and white quartz. The sample, consisting of six fragments, weighed one pound five ounces. Assays showed it to contain :

Gold.................. none.
Silver, at the rate of .... 6·825 ounces to the ton of 2,000 lbs.

39.—From the same shaft as the preceding specimen, but taken at a greater depth, namely, twenty feet.

It consisted of an association of pyrrhotite, iron-pyrites, and brown zinc-blende in a gangue of white translucent quartz. The sample, consisting of eight fragments, weighed one pound eight ounces. It was found to contain:

Gold.................. none.
Silver, at the rate of....14·117 ounces to the ton of 2,000 lbs.

40.—From the Wellington claim on Roche river, a tributary of the South Similkameen, Yale district. This, and the following specimen were examined for Mr. J. B. Wood.

An association of white translucent quartz with a little white dolomite, in parts coated with hydrated peroxide of iron and a little green carbonate of copper, carrying trifling quantities of specular iron and copper-glance. The sample, consisting of several fragments, weighed eight ounces.

It contained neither gold nor silver.

41.—From the Sailor Jack claim, same locality as the preceding specimen.

A white translucent quartz, coated with hydrated peroxide of iron and green carbonate of copper, carrying small quantities of copper-glance. The sample, consisting of several fragments, weighed eight ounces. Submitted to assay, it was found to contain:

Gold, at the rate of.....0·292 of an ounce to the ton of 2,000 lbs.
Silver, at the rate of....0·758 " " "

42.—From two miles south-east of the foot of Christina lake, Yale district. This, and the two following specimens were collected by Mr. R. W. Brock.

An association of white quartz with white felspar, small quantities of white calcite, black hornblende and fine scaly kaolinite, carrying small quantities of iron-pyrites and magnetite. The sample, consisting of several fragments, weighed two pounds eleven ounces.

It contained neither gold nor silver.

43.—From the Seattle claim, on the North Fork of Kettle river, Yale district.

An association of magnetite with a dark gray felspathic rock and a very little iron-pyrites. The sample, consisting of several fragments, weighed one pound four ounces.

It contained neither gold nor silver.

44.—Also from the Seattle claim.

A massive copper-pyrites with which was associated a very small quantity of magnetite. The sample, a single fragment, weighed three ounces. Assays showed it to contain:

Gold ....distinct trace.
Silver, at the rate of....0·700 of an ounce to the ton of 2,000 lbs.

45.—From a prospecting tunnel on a group of claims on the west side of the Fraser, south of Chilcotin river, and opposite to Dog creek and Little Dog creek, Lillooet district.

An association of white quartz with an altered white felspar, carrying somewhat large quantities of copper-pyrites. The sample, a single fragment, weighed nine ounces. Assays gave:

Gold.......... ....none.
Silver, at the rate of....1·750 ounce to the ton of 2,000 lbs.

46.—From a vein, of some six feet in width, near Watson Bar creek and about four miles west of the Fraser, Lillooet district

An association of brownish-black zinc-blende, mispickel, pyrrhotite and copper-pyrites, in a gangue of white sub-translucent quartz. The sample, a single fragment, weighed one pound nine ounces. It was found to contain:

Gold, at the rate of.....0·700 of an ounce to the ton of 2,000 lbs.
Silver, at the rate of....0·467 " " "

47.—From the head-waters of Texas creek, on the west side of the Fraser, some eight or ten miles below the town of Lillooet, Lillooet district.

A massive copper-pyrites, coated with hydrated peroxide of iron and green carbonate of copper. The sample, consisting of two fragments, weighed two ounces. Assays showed it to contain:

Gold.... ....trace.
Silver.............. ....none.

48.—From a vein about half way down, and about a mile and a half back from, Seton lake, Lillooet district.

An association of grayish-white quartz with a very little white calcite, carrying somewhat large quantities of iron-pyrites and of mispickel. The sample, a single fragment, weighed ten ounces. Submitted to assay, it was found to contain :

Gold, at the rate of....0·583 of an ounce to the ton of 2,000 lbs.
Silver. ....none.

49.—From a vein of some ten feet in width north-west of Anderson lake, Lillooet district.

A grayish-white translucent quartz, in parts coated with green carbonate of copper, carrying small quantities of copper-pyrites. The sample, a single fragment, weighed four ounces. It contained :

Gold........ .... distinct trace.
Silver, at the rate of....1·050 ounce to the ton of 2,000 lbs.

50.—From a vein near Dog creek, on the east side of the Fraser, Lillooet district.

An association of a black schistose rock with a little white quartz, carrying small quantities of iron-pyrites. The sample, a single fragment, weighed two ounces. Assays gave :

Gold..................none.
Silver, at the rate of....0·117 of an ounce to the ton of 2,000 lbs.

51.—From the Cassiar district.

A gray quartz, through which was distributed some iron-pyrites and copper-pyrites. The sample, consisting of eight fragments, weighed one pound thirteen ounces. Assays showed it to contain :

Gold..... .... distinct trace.
Silver, at the rate of.... 2·800 ounces to the ton of 2,000 lbs.

52.—This, and the three following specimens were described as coming from the vicinity of Mission city, Fraser river, New Westminster district.

It consisted of a white, granular quartz carrying small quantities of tetrahedrite. The sample, a single fragment, weighed ten ounces. It was found to contain :

Gold.................. none.
Silver, at the rate of....140·992 ounces to the ton of 2,000 lbs.

53.—A gray felspathic rock carrying small quantities of iron-pyrites.

The sample, consisting of two fragments, weighed eight ounces Assays gave :

Gold................. none.
Silver, at the rate of.... 0·525 of an ounce to the ton of 2,000 lbs.

54.—A dark gray to grayish-white quartz carrying small quantities of iron-pyrites. The sample, a single fragment, weighed ten ounces. It contained:

Gold....................	none.
Silver, at the rate of....	0·233 of an ounce to the ton of 2,000 lbs.

55.—A coarse grained granite through which was disseminated a few grains of iron-pyrites. The sample, a single fragment, weighed five ounces. Assays showed it to contain:

Gold....................	none.
Silver, at the rate of....	0·117 of an ounce to the ton of 2,000 lbs.

56.—From the vein worked at Brown Jug claims numbers one, two, and three, of the Brown Jug group, on Hesquoit lake, west coast of Vancouver island. Examined for Mr. A. L. Smith.

The material consisted of an association of a fine scaly, white mica, and white calcite, holding small quantities of iron-pyrites and brown zinc-blende. The sample, consisting of two fragments, weighed fourteen ounces. Assays gave:

Gold, at the rate of....	0·058 of an ounce to the ton of 2,000 lbs.
Silver, at the rate of....	0·758 " " "

57.—Another sample of material from the vein referred to in connection with the preceding specimen, and which was said, by Mr. A. L. Smith, to represent a better average of the vein, consisted of a light gray granitic rock carrying small quantities of brownish-black zinc-blende and a very little iron-pyrites. The sample, consisting of four fragments, weighed thirteen ounces. This, on being submitted to assay was found to contain:

Gold, at the rate of....	0·583 of an ounce to the ton of 2,000 lbs.
Silver, at the rate of....	3·092 ounces " "

NATURAL WATERS.

1.—Water from a cold spring in Pine creek valley, a shallow depression immediately behind the town of Atlin, on the east side of Atlin lake, Cassiar district, province of British Columbia. Collected by Mr. W. J. B. Pinder.

Agreeably with the observations of Mr. J. C. Gwillim, who has worked out the general geology of this part of the district of Cassiar, the spring is situate some three hundred yards north-north-west of the town of Atlin, where it is found issuing from the highest point of a slightly raised and gently sloping deposit of a white, more or less firmly compacted, yet readily friable material—more specifically referred to beyond, of about an acre in extent. There are several other deposits of a similar material, the largest of which has an area of from three to four acres, in this portion of the valley, the rocks underlying which are essentially magnesian, consisting chiefly of peridotite, serpentine, and magnesite.

The water as it issues from the spring is, as Mr. Pinder informs me, quite clear and colourless, is just perceptibly aerated, and has a temperature, as recorded by a very accurate thermometer, of 33° F., that of the atmosphere, in the shade, being at the time 65° F. This observation was made on the 10th of June, 1901. Another was made by him about a year later, namely, on the 5th of June, 1902, and with precisely the same results; hence the temperature of the water of this spring would appear to remain constant. He has also very carefully computed the discharge from this spring, and found the same to be three imperial gallons a minute; there are, however, several smaller springs bubbling out a little below and around this—the main one, the combined flow from which he estimated to be about two gallons a minute, thus making a total outflow of five gallons a minute or seven thousand two hundred gallons per diem.

It may be mentioned that the water employed for analysis was collected by Mr. Pinder in stoppered glass bottles of the kind technically known as 'Winchester Quarts,' and that in such a careful manner, and with so close an observance of all the necessary precautions, as to lead him to infer that the loss of carbonic acid incurred during the operation, if indeed there was any, would be quite inappreciable. It was forwarded while the weather was comparatively cool; arrived in excellent condition; was immediately placed in a cool dark cellar, and there kept pending its analysis.

At the time of examination, it was found to be perfectly clear and appeared, when seen in a clear glass vessel of about a pint capacity, quite colourless; when viewed in a column two feet in length, however, it was found to have a pale brownish-yellow hue. It was quite odourless; had, at the ordinary temperature, an agreeably acidulous taste which, however, soon gave place to a faintly bitter one; reacted very faintly acid, when evaporated to a small volume, however, slightly alkaline. Its specific gravity, at 15·5° C., was found to be 1007·91. On being poured into an open vessel, there ensued a slight effervescence, the water became cloudy, subsequently turbid, and ultimately deposited carbonate of magnesium. Boiling produced a copious precipitate consisting, chiefly, of magnesium carbonate with some calcium carbonate and a very litte ferric hydrate.

Conformably with the results of an analysis by Mr. F. G. Wait, 1000 parts, by weight, of this water, at 15·5° C., contained :

Potassa	0·0145
Soda	0·0796
Lime	0·1635
Magnesia	1·9204
Alumina	0·0065
Ferrous oxide	0·0067
Sulphuric anhydride	0·0501
Phosphoric anhydride	trace.
Boric anhydride	trace.
Carbonic anhydride	5·9360
Chlorine	0·0015
Silica	0·0825
Organic matter	trace.
	8·2633
Less oxygen, equivalent to chlorine	·0003
	8·2630

The foregoing acids and bases may reasonably be assumed to be present in the water in the following state of combination :

(The carbonates being calculated as mono-carbonates, and all the salts estimated as anhydrous.)

Potassium sulphate	0·0268
Sodium chloride	0·0025
" sulphate	0·0671
" carbonate	0·0838
" phosphate	trace.
" biborate	trace.
Calcium carbonate	0·2920
Magnesium carbonate	4·0328
Ferrous carbonate	0·0140
Alumina	0·0065
Silica	0·0825
Organic matter	trace.
	4·6080
Carbonic anhydride, half-combined	2·2810
" free	1·3740
	8·2630

Total dissolved solid matter, by direct experiment, dried at 180° C., = 4·428.

An imperial gallon of the water, at 15.5° C., would contain:

(The carbonates being calculated as anhydrous bicarbonates, and the salts without their water of crystallization.)

	Grains.
Potassium sulphate	1·8908
Sodium chloride	0·1764
" sulphate	4·7341
" bicarbonate	8·3676
" phosphate	trace.
" biborate	trace.
Calcium bicarbonate	29·6677
Magnesium bicarbonate	433·5644
Ferrous bicarbonate	1·3617
Alumina	0·4586
Silica	5·8206
Organic matter	trace.
	486·0419
Carbonic anhydride, free	96·9403
	582·9822

Lithia, baryta, strontia, bromine and iodine, were sought for, and with negative results.

In order to obtain some idea of the nature of the material deposited by this spring, Mr. Pinder made a cutting, of about three feet in width and some six feet in depth, in the deposit close to where the spring bubbles out; took measurements of the various layers exposed; and having collected samples from each, forwarded the same to me for examination By this means it was ascertained that—the uppermost layer of the deposit consists of a grayish-white hydromagnesite, having a thickness of from eighteen to twenty-four inches; immediately under which there is a comparatively thin layer of a grayish-white to light-gray and bluish-ash coloured, somewhat magnesian, calcareous tufa; followed by a layer of some three inches of a yellowish-brown to light and dark brown ferruginous, calcareous tufa; which is succeeded by a thin layer of a light brownish-yellow, ferruginous, slightly magnesian, calcareous tufa; and under this again, there is a layer of four feet and more—how much, was not ascertained, the cutting not having been carried to a greater depth,—of a brownish-red, ferruginous, somewhat magnesian, calcareous tufa.

As already mentioned, there are several other deposits of a like material not far removed from that in question, in the same part of the valley. In alluding to these, Mr. Gwillim remarks

—'these are quite dry during the summer season, but in spring, it is said, springs issue all along their course'.

There can, I think, be little doubt but that all these deposits of hydromagnesite occurring at the back of Atlin town-site, owe their origin to the water of springs of very similar, if not precisely the same, composition as that of which the analysis is given above. It is also not improbable that the large deposits of hydromagnesite, situate some six hundred and seventy-five miles south-east of those just referred to, in the immediate vicinity of the 108-mile House, on the Cariboo road, ninety-three miles north of Ashcroft, in the district of Lillooet, and of which mention is made in one of my previous reports—see Annual Report of this Survey for 1898, vol. xi, p. 10 R,—have a similar origin.

The material of these deposits, as likewise the water of the spring in question, will, most probably, in the near future receive the attention they deserve, as a source of magnesia.

2.—Water from a spring on the St. Georges farm, on Gamache or Ellis Bay, which is on the south side and near the west end of the island of Anticosti, Gulf of St. Lawrence, province of Quebec. The spring rises, either from the lowest division of the Anticosti group, or the immediately underlying Hudson River or Loraine formation. It was sent by, and examined for Dr. Jos. Schmitt.

The sample received, contained a very trifling quantity of light-brown, flocculent matter in suspension, which was removed by filtration. The filtered water was clear, bright and, apparently, colourless; when viewed in a column two feet in length, however, it exhibited a pale brownish-yellow colouration. It was odourless, and devoid of any marked taste. It reacted neutral, but after evaporation to a small volume the reaction was rather strongly alkaline. The specific gravity, at 15·5° C., was found to be 1000·66. Boiling produced a small precipitate, consisting of calcium carbonate with a little magnesium carbonate.

One thousand parts, by weight, of the filtered water, at 15·5° C., were found by Mr. F. G. Wait to contain:

Potassa	0·0105
Soda	0·3000
Lime	0·0559
Magnesia	0·0359
Ferrous oxide	trace.
Sulphuric anhydride	0·0550
Carbonic anhydride	0·2523
Chlorine	0·2235
Silica	0·0165
Organic matter	trace.
	0·9496
Less oxygen, equivalent to chlorine	0·0503
	0·8993

The foregoing acids and bases may reasonably be assumed to be present in the water in the following state of combination :

(The carbonates being calculated as monocarbonates, and all the salts estimated as anhydrous.)

Sodium chloride	0·3683
Potassium sulphate	0·0194
Sodium sulphate	0·0818
Sodium carbonate	0·1183
Calcium carbonate	0·0998
Magnesium carbonate	0·0754
Ferrous carbonate	trace.
Silica	0·0165
Organic matter	trace.
	0·7795
Carbonic anhydride, in excess of that required to form monocarbonates	0·1198
	0·8993

Total dissolved solid matter, by direct experiment, dried at 180° C., = 0·750.

An imperial gallon of the water, at 15·5° C., would contain :

(The carbonates being calculated as anhydrous bicarbonates, and the salts without their water of crystallization.)

	Grains.
Sodium chloride	25·798
Potassium sulphate	1·359
Sodium sulphate	5·730
Sodium bicarbonate	11·726
Calcium bicarbonate	10·066
Magnesium bicarbonate	8·048
Ferrous bicarbonate	trace.
Silica	1·156
Organic matter	trace.
	63·883
Less carbonic anhydride employed in excess of that actually found	0·890
	62·993

The amount of carbonic anhydride found was, it will be seen, somewhat less than that required for the conversion of all the monocarbonates into bicarbonates; hence, it is apparent that the bases represented as carbonates cannot all exist in the form of bicarbonates, although it has been deemed best, on this occasion, to so represent them. A like deficiency of carbonic anhydride has, it may be remarked, often been noted in some of the waters of other Canadian springs.

There was not enough of the water to allow of its being examined for baryta, strontia, boric acid, bromine and iodine.

This water belongs to the fourth class of Dr. T. Sterry Hunt's classification of mineral waters.

3.—Water from a spring on the farm of Angus Cameron, on the west side of Margaree river, about a mile and a half below Scotsville, Inverness county, province of Nova Scotia. Examined for Mr. J. H. Cameron.

The sample of water received for examination contained a trifling quantity of white, flocculent, organic matter in suspension. This was removed by filtration. The filtered water was clear, bright, and had a faint brownish-yellow colour. It was odourless, had a mildly saline taste, and reacted neutral, both before and after concentration. Its specific gravity, at 15·5° C., was found to be 1002·5. The total dissolved saline matter, dried at 180° C., amounted to 4·50 parts per 1000,—equivalent to 315·7 grains per imperial gallon.

A qualitative analysis, by Mr. Wait, showed it to contain:

Potassa	very small quantity.
Soda	somewhat large quantity.
Lime	rather small quantity.
Magnesia	very small quantity.
Sulphuric anhydride	rather small quantity.
Carbonic anhydride	small quantity.
Chlorine	somewhat large quantity.
Silica	trace.
Organic matter	faint trace.

Boiling produced a slight precipitate, consisting essentially of calcium carbonate with a very little magnesium carbonate.

4.—Water from a well in the town of Lunenburg, Lunenburg county, province of Nova Scotia.

This, when received contained a trifling quantity of white, flocculent, organic matter in suspension, which, having been removed by filtration, left the water clear, bright, and, apparently colourless, although when viewed in a column two feet in length it was found to have a faint brownish-yellow colouration. It was odourless, devoid of any marked taste, and reacted neutral, both before and after concentration. The total dissolved saline matter, dried at 180° C., amounted to 0·26 parts per 1000, which would be equivalent to 18·2 grains per imperial gallon.

A qualitative analysis, by Mr. Wait, indicated the presence of:

Soda	very small quantity.
Ammonia	trace.
Lime	small quantity.
Magnesia	very small quantity.
Ferrous oxide	trace.
Sulphuric anhydride	very small quantity.
Carbonic anhydride	small quantity.
Chlorine	very small quantity.
Silica	trace.
Organic matter	very small quantity.

Boiling produced a slight precipitate, consisting of calcium carbonate with a very little magnesium carbonate.

5.—Water from a spring occurring four miles from Andover, and on what is known as the Indian Reserve, Victoria county, province of New Brunswick. Examined for Mr. J. E Stewart.

The sample of water sent for examination, contained a trifling quantity of light-brown, flocculent matter in suspension. After removal of this by filtration, the water was found to be clear, bright, and of a faint brownish-yellow colour. It was devoid of odour, and did not possess any marked taste. Reaction, neutral; when evaporated to a small volume, however, faintly alkaline. Its specific gravity, at 15·5° C., was found to be 1000·5. It contained 0·166 parts of dissolved saline matter, dried at 180° C., in 1000 parts, by weight, of the water,—equivalent to 11·63 grains per imperial gallon.

A qualitative analysis, by Mr. Wait, showed it to contain:

Soda	very small quantity.
Lime	small quantity.
Magnesia	very small quantity.
Sulphuric anhydride	very small quantity.
Carbonic anhydride	rather small quantity.
Chlorine	very small quantity.
Silica	trace.
Organic matter	faint trace.

Boiling produced a small precipitate, consisting, mainly, of calcium carbonate with a little magnesium carbonate.

6.—Water from a boring at Ramsay's Corners, on the eighteenth lot of the seventh concession of the township of Gloucester, Carleton county, province of Ontario. It was taken at a depth of eight hundred and sixty-one feet from the surface, and issues, according to Dr. H. M. Ami, from limestones of the Trenton formation, Cambro-Silurian. Examined for Mr. John Cunningham.

It contained a small quantity of a slightly calcareous, earthy sediment, which was removed by filtration. The filtered water was perfectly clear and bright, and of a faint brownish-yellow colour. It had a faint odour of petroleum; tasted mildly saline; and reacted neutral, both before and after concentration. Its specific gravity, at 15·5° C., was found to be 1014. The total dissolved saline matter, dried at 180° C., amounted to 17·87 parts per 1000, by weight, of the water,—equivalent to 1252·9 grains per imperial gallon.

A qualitative analysis, conducted by Mr. Wait, gave as follows:

Potassa	very small quantity.
Soda	rather large quantity.
Ammonia	strong traces.
Lime	somewhat large quantity.
Magnesia	very small quantity.
Ferrous oxide	very small quantity.
Carbonic anhydride	small quantity.
Chlorine	large quantity.
Bromine	trace.
Iodine	trace.
Silica	trace.
Organic matter	trace.

Boiling produced a small precipitate, consisting of ferric hydrate with some calcium carbonate.

7.—Water from a spring on the farm of Mr. J. W. Brumwell, on the first lot of the first concession of the township of Scarborough, York county, province of Ontario.

It contained a small quantity of light-brown flocculent matter in suspension, which, on removal by filtration, was found to consist of organic matter with a little ferric hydrate. The filtered water was clear, bright, and when seen in small volume colourless, but when viewed in a column two feet in length it was found to have a brownish-yellow hue. It had a faint unpleasant odour, as of decaying vegetable matter, and, what may be best described as a flat taste. Reaction, neutral; when evaporated to a small volume, however, faintly alkaline. Its specific gravity, at 15·5° C., was found to be 1001·5. The total dissolved saline matter, dried at 180° C., amounted to 1·024 parts per 1000, which would be equivalent to 71·82 grains per imperial gallon.

A qualitative analysis, by Mr. Wait, indicated the presence of:

Potassa	trace.
Soda	small quantity.
Lime	small quantity.
Magnesia	very small quantity.
Ferrous oxide	trace.
Carbonic anhydride	rather small quantity.
Chlorine	rather small quantity.
Silica	trace.
Organic matter	very small quantity.

In addition to the foregoing—a small quantity of ammonia, as likewise of nitrites, and traces of nitrates, were also found to be present. A determination of the oxygen consuming power, showed an absorption of not less than 22·8 parts per million.

Boiling produced a small precipitate, consisting of calcium carbonate with a little magnesium carbonate and a very little ferric hydrate.

8.—Water from a well in the village of St. Joseph, township of Hay, Huron county, province of Ontario.

The sample received for examination, was slightly turbid, but otherwise free from suspended matter. After filtration it was perfectly clear, bright, and apparently colourless; when viewed in a column two feet in length, however, it was seen to have a faint brownish-yellow tint. It was odourless, devoid of any marked taste, and reacted neutral, both before and after concentration. Its specific gravity, at 15·5° C., was found to be 1000·5. The total dissolved saline matter, dried at 180° C., amounted to 0·63 parts per 1000,—equivalent to 44·1 grains per imperial gallon.

A qualitative analysis, by Mr. Wait, showed it to contain:

Soda	very small quantity.
Lime	small quantity.
Magnesia	trace.
Ferrous oxide	trace.

Sulphuric anhydride	small quantity.
Carbonic anhydride	very small quantity.
Chlorine	very small quantity.
Silica	trace.
Organic matter	trace.

Boiling produced a very small precipitate, consisting of calcium carbonate.

9.—Water from a small spring bubbling out of the hillside at Chilcotin, about twenty-three miles from Chimney Creek ferry, Cariboo district, province of British Columbia.

It was perfectly clear, bright, and colourless ; devoid of odour ; and had a slight, agreeably acidulous taste. Reaction, neutral ; both before and after concentration. The total dissolved saline matter, dried at 180° C., amounted to 2·84 parts per 1000, which would be equivalent to 198·8 grains per imperial gallon.

Mr. Wait found it to contain :

Soda	small quantity.
Lime	rather small quantity.
Magnesia	rather small quantity.
Sulphuric anhydride	small quantity.
Carbonic anhydride	rather large quantity.
Chlorine	small quantity.
Silica	trace.

Boiling produced a copious precipitate, consisting of calcium carbonate and magnesium carbonate, the former, apparently, preponderating.

The quantity of water sent for examination, was too limited to allow of more than the above partial qualitative analysis.

10.—Water from a spring above West Pinchbeck, Risky creek—a tributary of the Fraser, district of Cariboo, province of British Columbia. Examined for Mr. J. Isnardy.

The sample of this water which was sent for examination, was faintly turbid and contained a trifling quantity of brown, flocculent matter in suspension. This was removed by filtration. The filtered water was clear, colourless and bright. After exposure to the air for a short time, however, it became rapidly turbid from separation of sulphur, calcium carbonate, magnesium carbonate, and a very little ferric hydrate, and then presented a brownish-yellow colour. It had a slightly saline taste, and a faint odour of sulphuretted hydrogen. It reacted neutral ; after evaporation to a small volume, however, decidedly alkaline. Its specific gravity, at 15·5° C., was found to be 1003·5. The total dissolved saline matter, dried at 180° C., amounted to 2·81 parts per 1000,—equivalent to 197·4 grains per imperial gallon.

A qualitative analysis, by Mr. Wait, showed it to contain:

Soda	rather small quantity.
Lime	rather small quantity.
Magnesia	rather small quantity.
Ferrous oxide	trace.
Sulphuric anhydride	small quantity.
Carbonic anhydride	somewhat large quantity.
Chlorine	very small quantity.
Silica	trace.
Organic matter	faint trace.

Boiling produced a rather copious precipitate, consisting of calcium carbonate and magnesium carbonate with a little ferric hydrate.

The sulphuretted hydrogen—above referred to, had doubtless been formed by the reducing action of organic matter—the water having been put up in an ordinary corked bottle,—which coverts the sulphates into sulphurets; these, in their turn, being decomposed by carbonic acid, with the seperation of sulphuretted hydrogen.

11.—Water from a spring found issuing from an extensive body of a dark olive-green chloritic rock—derived apparently from the alteration of a massive andradite—which occurs about four miles back from the west bank of the Fraser river and nearly opposite the mouth of Big Bar creek, Lillooet district, province of British Columbia.

The sample of water received for examination, contained a somewhat large quantity of dark green, earthy matter in suspension. On removal of this by filtration, the water was found to be quite clear, and of a brownish-yellow colour. It was odourless, and devoid of any marked taste; reacted neutral, but when reduced to a small volume, faintly alkaline. It contained 0·506 parts of dissolved saline matter, dried at 180° C., in 1000 parts, by weight, of the water—equivalent to 35·42 grains per imperial gallon.

A qualitative analysis, by Mr. Wait, indicated the presence of:

Potassa	trace.
Soda	very small quantity.
Lime	small quantity.
Magnesia	very small quantity.
Ferrous oxide	trace.
Sulphuric anhydride	very small quantity.

Carbonic anhydride	rather small quantity.
Chlorine	trace.
Silica.	trace.
Organic matter.....	trace.

Boiling produced a small precipitate, consisting, essentially, of calcium carbonate with a little magnesium carbonate and a trace of ferric hydrate.

BRICK AND POTTERY-CLAYS.

1.—From near the top of the range of hills known as Marble Mountain, in a valley facing towards the south or Bras d'Or lake, Inverness county, province of Nova Scotia, where it forms a deposit which is covered by several feet of soil. Examined for Mr. A. Bain.

A non-calcareous, strongly plastic clay, containing but very little gritty matter. When burnt it assumes a light reddish-brown colour. The burnt mass, which is exceptionally hard and firm, is readily fusible at a somewhat elevated temperature. It is well adapted for the manufacture of ordinary building brick, drain tiles, and all kinds of common earthenware.

2.—From the left bank of the Miramichi, about eighteen miles from its entrance into Miramichi Bay, Northumberland county, province of New Brunswick. Examined for Mr. R. C. Call.

A light reddish-brown, somewhat calcareous, plastic clay, containing a large proportion of arenaceous matter. When burnt it assumes a reddish-brown colour. It is somewhat easily fusible at an elevated temperature. It affords a very strong brick.

3.—From the farm of John Ken, Summer Hill, parish of Gagetown, Queens county, province of New Brunswick. Examined for Mr. C. D. Jones.

A purplish-blu[illegible]sh coloured, slightly calcareous, somewhat ferruginous, rather strongly plastic clay, containing but a very small proportion of gritty matter. When burnt it assumes a purplish-brown colour. It is somewhat difficultly fusible at an elevated temperature. This clay might—the colour of the burnt material not being considered objectionable,—be advantageously employed for the manufacture of ordinary building brick, and all kinds of common earthenware.

4.—From the mouth of Savage river, tributary of the Patapedia, Bonaventure county, province of Quebec. Examined for Mr. J. Robinson.

A light to dark bluish-gray, yellowish-gray, brownish-yellow, and reddish-brown—mottled, non-calcareous, more or less ferruginous, rather strong plastic, somewhat readily fusible clay, containing little or no gritty matter, and which when burnt assumes a very pleasing bright reddish-brown colour. It is well adapted for the manufacture of ordinary building brick, and all kinds of common earthernware.

5.—From lot four hundred and fifty-nine of the first range north-east, on the Chaudière, in the seigniory of St. Joseph, Beauce county, province of Quebec.

This clay has, in the moist condition, a dark purplish-brown—when air-dried, however, a light, slightly reddish, gray colour. It is slightly calcareous; contains only a very small quantity of very fine grit, and is highly plastic. When burnt it assumes a light reddish-brown colour. It fuses somewhat readily at an elevated temperature to a brownish-gray enamel. It might advantageously be employed for the manufacture of ordinary building brick and common pottery.

6.—From the thirty-fourth lot of the sixth concession of the township of Lancaster, Glengarry county, province of Ontario. Examined for Mr. D. B. McDonald.

A light greenish-gray, non-calcareous, highly plastic, somewhat readily fusible clay, containing but a very small proportion of gritty matter. When burnt it assumes a light reddish-brown colour. It constitutes an excellent clay for the manufacture of ordinary building brick, and all kinds of common earthenware.

7.—From the [illegible]th lot of the eleventh concession of the township of Greenock, Bruce county, province of Ontario.

An ash-gray, calcareous, plastic, somewhat readily fusible clay. Of two samples, taken from different parts of the deposit, one contained, approximately, 18·5 per cent of carbonate of lime, and the other 20·8 per cent of carbonate of lime. Both afforded a strong brick of a light reddish-brown colour.

8.—From the same locality as the preceding specimen, but from a different part of the deposit. Examined for Mr. J. W. McNab.

An arenaceous clay, containing a somewhat large proportion of minute rounded grains of quartz, a small proportion of fine particles of limestone and of dolomite, a few particles of felspar, of mica and of a chloritic mineral, together with a trifling quantity of organic matter (vegetable fibre), and an occasional speck of iron-pyrites. It is but feebly plastic, and readily fusible at a somewhat elevated temperature. The burnt mass is quite tender, hence this material is quite unsuited for the manufacture of bricks.

9.—From a point on the Red Deer river, district of Alberta, North-west Territory, where it occurs immediately underlying a small seam of lignite. Examined for Mr. F. E. Wilkins.

A light to dark bluish-gray, more or less highly calcareous, slightly ferruginous, somewhat strongly plastic, rather readily fusible clay, almost free from gritty matter. It affords a strong brick, of a pale dull yellow colour.

10.—From one mile west of the junction of the South Fork and Little South Fork of Old Man river, district of Alberta, North-west Territory. Received from Mr. J. E. Woods, D.L.S.

A dark brownish-red indurated clay, which proved to be non-calcareous, and highly plastic. It is somewhat difficultly fusible at an elevated temperature. It affords a strong brick of a bright reddish-brown colour. This clay might advantageously be employed for the manufacture of ordinary building brick, drain-tiles, and all kinds of common earthenware.

11.—From a deposit on Arrow lake, in the West Kootenay district of the province of British Columbia. Examined for Mr. T. McNaughton.

A light bluish-ash coloured, non-calcareous, slightly ferruginous, laminated clay traversed by an occasional very thin layer of, intimately associated, minute grains of quartz, felspar and hornblende, and fine scales of mica. It forms with water a somewhat strongly plastic mass. Is readily fusible at a somewhat elevated temperature to a black, shining, vitrified mass. It affords a strong brick, of a reddish-brown colour.

12.—From Texada island, Strait of Georgia, province of British Columbia, where it occurs in the Cretaceous. Received from Mr. Walter Harvey.

A highly ferruginous clay, which, when reduced to powder, forms with water a strongly plastic mass. This, when burnt, retains the original brownish-red colour, is very hard and firm, and difficultly fusible at an elevated temperature. It would make an excellent building brick, and might likewise, after having been ground to powder and mixed with oil or water, be used as a cheap pigment.

MISCELLANEOUS EXAMINATIONS.

1.—**Bog manganese.** From about half a mile back from Jones Forks—a tributary of the Keswick, parish of Douglas, York county, province of New Brunswick, where it occurs in the form of nodules imbedded in the soil. The nodules, which are exteriorally of a clove-brown, and interiorally of a blackish-brown colour, have a varying diameter of from ten to twenty-three millimetres. A partial analysis of the same, by Mr. Wait, showed them to contain—peroxide of manganese 27·04; peroxide of iron 4·50; insoluble matter consisting of quartz grains, argillaceous matter, etc., 36·37; water, hygroscopic and combined, and organic matter 28·11.

2.—**Coal.** From section 24, township 6, range 23, west of the fourth principal meridian, district of Alberta, North-west Territory. Thickness of seam, about eight feet. Examined for Mr. F. C. Potts.

It was found to contain 4·75 per cent of water, and on incineration left 4·05 per cent of a brownish-red ash. By fast coking, it gave a firm, coherent coke.

3.—**Coal.** From the Coal creek, Michel, and Morrissey mines, Crow's Nest coal-field, district of Alberta, North-west Territory. The specimens, in question, were collected by Mr. T. C. Denis. These in the condition in which they were received, were found to contain as follows—

Coal from the Coal creek mine, No. 1 working, 0·53 per cent of water and 19·20 per cent of a grayish-white ash: No. 2 working, 0·49 per cent of water and 5·93 per cent of a yellowish-white ash; No. 3 working, 0·47 per cent of water and 7·72 per cent of a reddish-white ash.

Coal from the Michel mine, No. 3 working, 0·62 per cent of water and 4·16 per cent of a reddish-white ash; No. 4 working, 0·57, per cent of water and 5·80 per cent of a faint reddish-white ash; No. 8 working, 0·62 per cent of water and 3·68 per cent of a light reddish-white ash.

Coal from the Morrissey mine, No. 1 working, 0·56 per cent of water and 16·38 per cent of a faint reddish-white ash; No. 4 working, 0·56 per cent of water and 13·78 percent of a faint reddish-white ash; No. 5 working, 0·50 per cent of water and 21·21 per cent of a faint reddish-white ash.

It may fairly be assumed that the above samples of fuel had all lost a certain proportion of their water during the interval of their collection and examination. They all yield, by fast coking, a firm dense coke.

4.—COAL. From near the head of Kettle river, Yale district, province of British Columbia. Examined for Mr. G. E. Corbould.

The specimen sent for examination contained 1·58 per cent of water, and on incineration left 34·79 per cent of a light reddish-brown ash. It gave, by fast coking, a firm compact coke.

5.—COAL, Lignitic. From the same locality as the preceding specimen.

The particular sample examined contained 12·89 per cent of water, and left on incineration 1·62 per cent of a very light reddish-brown coloured ash. It gave, by fast coking, a firm coherent coke.

6.—GRAPHITE. From the west-half of the ninth lot of the tenth concession of the township of Ross, Renfrew county, province of Ontario.

The sample sent for examination was found to contain 58·65 per cent of graphite.

7.—GRAPHITE, Disseminated. Said to have been found in the vicinity of Rivers Inlet, province of British Columbia. Examined for Messrs. Mutrie & Brown.

The material sent for examination contained 20·22 per cent of graphite. It closely resembled that found by Mr. W. Downie, in 1860, at Alkow Harbour, Dean Canal, in the same province, a sample of which, collected by him, was found to contain 23·17 per cent of graphite.

8.—MANGANITE. A sample of material consisting apparently, of a mixture of manganite and limonite, from Soldier Cove, Bras d'Or lake, Richmond county, province of Nova Scotia, has been examined by Mr. F. G. Wait, and found to contain—manganese 36·64 = manganese sesquioxide 52·62, iron 18·72 = iron sesquioxide 26·74, insoluble matter 6·11, and water 13·18 per cent.

9.—PEAT. From the thirty-fourth lot of the sixth concession of the township of Lancaster, Glengarry county, province of Ontario. Examined for Mr. D. B. McDonald.

Its analysis afforded Mr. Johnston as follows—fixed carbon 17·6, volatile matter 75·4, ash of a light reddish-brown colour 7·0 – 100.

10.—PEAT. From a deposit some sixty-seven miles up from the mouth of the Kwataboahegan—a tributary of the Moose, district of Algoma, province of Ontario. Collected by Mr. W. J. Wilson.

The particular sample examined contained 7·25 per cent of water, and on incineration left 56·05 per cent of a light reddish-brown ash.

11.—PYRITE. From the fourteenth lot of the fifth range of the township of Masham, Ottawa county, province of Quebec.

The material examined consisted of a massive pyrite through which was distributed a small quantity of siderite, a few flakes of molybdenite, and a little gangue composed, mainly, of hornblende and quartz with a few scales of mica and a few minute crystals of apatite. A fair average of the sample, which weighed five pounds, was found by Mr. Wait to contain—46·32 per cent of sulphur.

12.—QUARTZ, Ferruginous. From the south-east corner of Black Sturgeon lake, about fifteen hundred paces east of the lake, district of Thunder Bay, province of Ontario. Collected by Dr. A. W. G. Wilson.

A brownish-red ferruginous quartz containing, in parts, a little specular iron. Determinations, by Mr. Wait, showed it contained —7·27 per cent of metallic iron.

13.—QUARTZ CONGLOMERATE, Ferruginous. From Georges river, Cape Breton county, province of Nova Scotia, where it is said to constitute a large deposit.

A fair average of a sample of this material was found by Mr. Wait to contain—15·11 per cent of metallic iron.

14.—SAND, AURIFEROUS. A sample of auriferous black sand from Adams Hill, near Bonanza creek, Yukon district, North-west Territory, has been examined by Mr. Wait for platinum, and with negative results. The sand consisted mainly of small, feebly magnetic, grains of titanic iron, with a few particles of magnetite, garnet and quartz, and an occasional grain of native gold.

15.—SAND, BLACK. A small sample of a black sand received from Mr. W. Perkins, White Horse, Yukon district, North-west Territory, was found, on examination by Mr. Johnston, to be composed of grains of a black ferriferous spinel and of a pale reddish coloured garnet, with a few grains of white quartz and an occasional particle of wood-tin. The spinel, which constituted, approximately, seventy per cent, by weight, of the sand, was found by Mr. Johnston to have a specific gravity, at 15·5° C., of 3·935, and is most probably hercynite.

16.—**Sand, Siliceous.** The following are the results of an examination, by Mr. R. A. A. Johnston, of carefully collected samples of this material from the large accumulations of the same which form, respectively, what is known as the Traverse Spit, at the foot of the Island of Orleans, and the Ste. Croix and Champlain shoals, between Three Rivers and Quebec, in the Lower St. Lawrence, province of Quebec.

To facilitate a comparison, the results are here given in a tabular form—Table 1, showing the nature and amount of the mineral constituents entering into the composition of the sands in question; and Table 2, the percentage amounts of the various sized grains composing said sands,—see beyond, pp. 66 67.

17.—**Sandstone**, Nodules of. From the vicinity of Sorel, Richelieu county, province of Quebec. Received from Mr. W. M. Seaborn.

An examination of these showed them to be composed of minute, more or less rounded, siliceous grains—chiefly of quartz, cemented together by calcium carbonate with a small quantity of magnesium carbonate and a little oxide of iron; a little calcium phosphate being also present. A partial analysis, by Mr. Wait, gave—insoluble siliceous matter 62·58, calcium carbonate 33·36, magnesium carbonate 2·39, calcium phosphate 0·31; with small quantities of soluble silica, alumina and peroxide of iron, undetermined.

18.—**Shale, Bituminous.** A dark brown, highly calcareous, bituminous shale or pyroschist, from Chambord, township of Metabetchouan, Chicoutimi county, province of Quebec, has been examined by Mr. Wait, and with the following results—hygroscopic water 0·59, volatile combustible matter 8·73, fixed carbon 11·20, ash, of a light yellowish-gray colour, 79·48 = 100·00.

19.—**Shale, Calcareous.** From Arnold, in the province of Manitoba. Collected by Mr. D. B. Dowling. There were two specimens. Of these, one, a dark bluish-gray shale, was found by Mr. Wait to contain 57·27 per cent of calcium carbonate; and the other, a brownish-yellow shale, 56·27 per cent of calcium carbonate.

TABLE 1.

SHOWING the composition of the sand forming the Traverse Spit, at the foot of the island of Orleans, and of that forming the Ste. Croix and Champlain shoals, between Three Rivers and Quebec, in the Lower St. Lawrence, province of Quebec.

Sand,—whence obtained.	CONSTITUENTS, PER CENT.			Remarks.
	Grains of Quartz.	Grains of black tourmaline and of red garnet.	Grains of magnetite.*	
From the highest point of surface of Traverse Spit..	95·7	4·0	0·3	Contained a few splinters of pale blue cyanite.
" the surface of Traverse Spit	86·4	13·0	0·6	
" 15 inches below the surface of Traverse Spit...	89·0	10·0	1·0	
" 8 to 10 feet " " " " ..	94·9	4·0	0·2	Contains 0·9 p. c. of clay and numerous scales of mica.
" 22 to 27 feet " " " " ..	89·2	10·0	0·8	
" 28 to 33 feet " " " " ..	93·6	6·0	0·4	
" the Ste. Croix shoal..................	81·0	16·0	3·0	Contains a few splinters of pale blue cyanite.
" the Champlain shoal..................	91·8	7·2	1·0	Contains a few splinters of pale blue cyanite.

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* See foot-note to Table 2.

TABLE 2.

Showing the size of the grains of sand forming the Traverse Spit, at the foot of the island of Orleans, and of that forming the Ste. Croix and Champlain shoals, between Three Rivers and Quebec, in the Lower St. Lawrence, province of Quebec.

Sand,—whence obtained.	Percentage of grains consecutively separated by sieves having, respectively, the undermentioned number of holes to the linear inch.						
	100.	80.	60.	40.	20.	16.	Rejected by sieve having 16 holes to the linear inch.
From the highest point of surface of Traverse Spit..	12·6	17·4	58·0	11·8	0·2	—	
" the surface of Traverse Spit.......... ..	16·1	22·0	18·9	12·5	0·5	—	A few grains only.
" 15 inches below the surface of Traverse Spit...	29·3	27·8	12·6	0·2	0·1	—	
" 8 to 10 feet " " " " ..	33·1	33·2	32·7	0·4	0·6	—	
" 22 to 27 feet " " " " ..	8·8	10·7	33.4	42·8	4·1	0·2	A few flakes of mica.
" 28 to 33 feet " " " " ..	4·8	5·0	16·0	37·2	35·4	1·3	0·3
" the Ste. Croix shoal.........	3·5	5·0	17·5	50·9	22·3	0·5	0·3
" the Champlain shoal..............	0·6	0·4	1·5	5·4	87·1	3·4	1·6

Note.—It was found that the sand rejected by the sieve having sixty holes to the linear inch was, in all cases, practically free from magnetite.